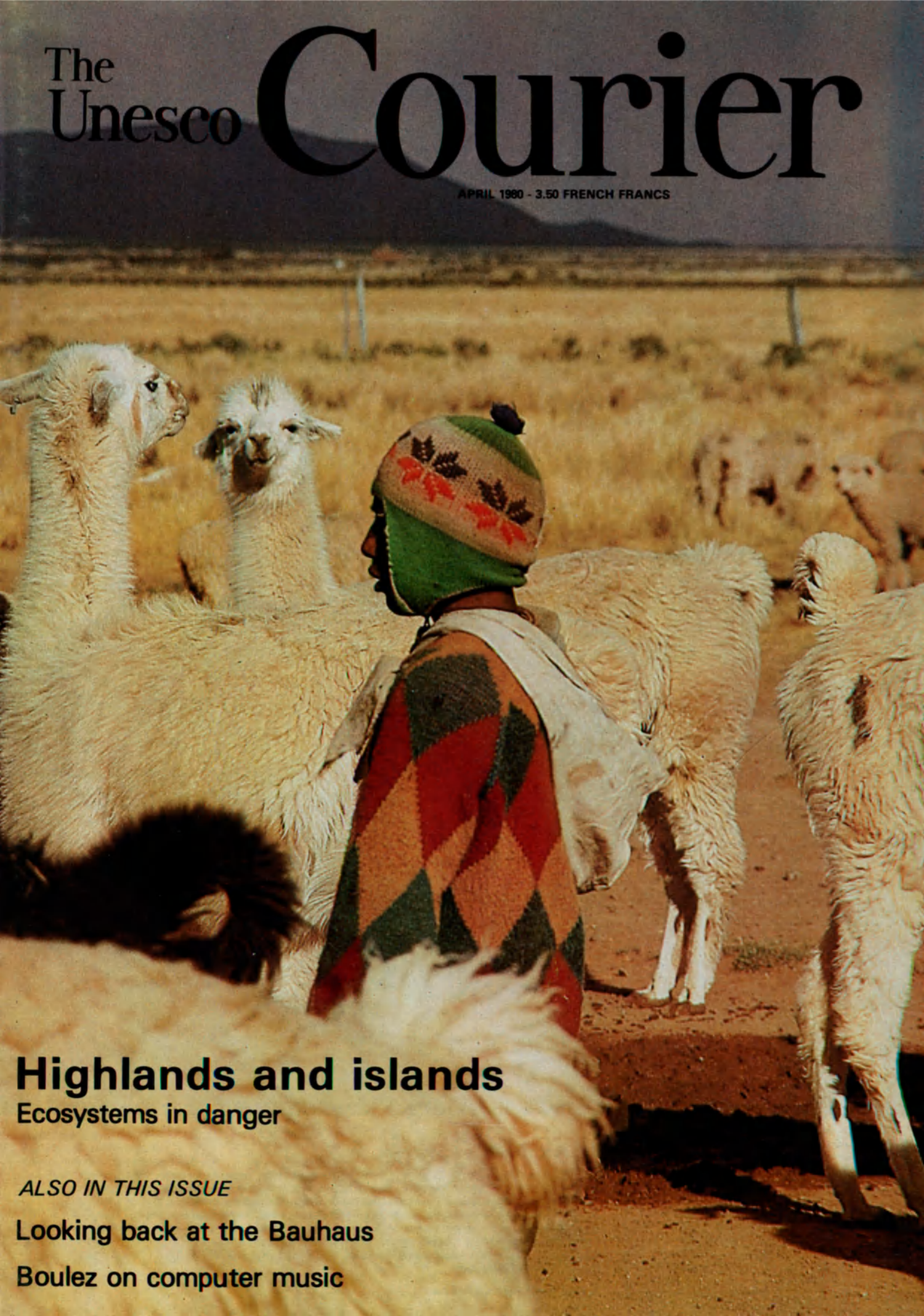
The Unesco Courier

APRIL 1980 - 3.50 FRENCH FRANCS



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U.S.S.R.

St. Sergius in stitchwork

The artistic flowering of early fifteenth-century Russia, associated with the icon painter Andrei Rublëv and other Masters, also produced remarkable examples of the art of embroidery such as this expressive portrait head with magnetic gazing eyes. It is part of a full-length study, executed some years after its subject's death, of St. Sergius of Radonezh (1314-1392), a leading figure in fourteenth-century Russian history who was hailed as his country's saint-protector. He is widely known as the founder of the great Trinity-St. Sergius Monastery not far from Moscow in what is today the town of Zagorsk, where this portrait is now preserved in the National Museum.

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The Unesco Courier
A window open in the world
APRIL 1980 33rd YEAR

PUBLISHED IN 20 LANGUAGES

English	Italian	Turkish
French	Hindi	Urdu
Spanish	Tamil	Catalan
Russian	Hebrew	Malaysian
German	Persian	Korean
Arabic	Dutch	Swahili
Japanese	Portuguese	

Published monthly by UNESCO
The United Nations
Educational, Scientific
and Cultural Organization

Sales and Distribution Offices
Unesco, Place de Fontenoy, 75700 Paris

Subscription rates
1 year : 35 French Francs
2 years: 58 FF
Binder for a year's issues: 29 FF

The UNESCO COURIER is published monthly, except in August and September when it is bi-monthly (11 issues a year). For list of distributors see inside back cover.
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The Unesco Courier is produced in microform (microfilm and/or microfiche) by: (1) University Microfilms (Xerox). Ann Arbor, Michigan 48100, U.S.A.; (2) N.C.R. Microcard Edition, Indian Head, Inc., 111 West 40th Street, New York, U.S.A.; (3) Bell and Howell Co., Old Mansfield Road, Wooster, Ohio 44691, U.S.A.

The Unesco Courier is indexed monthly in the Readers' Guide to Periodical Literature, published by H.W. Wilson Co., New York, and in Current Contents - Education, Philadelphia, U.S.A.

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ISSN 0041-5278
N° 3 - 1980 - OPI - 80 - 1 - 363 - A

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Special supplement

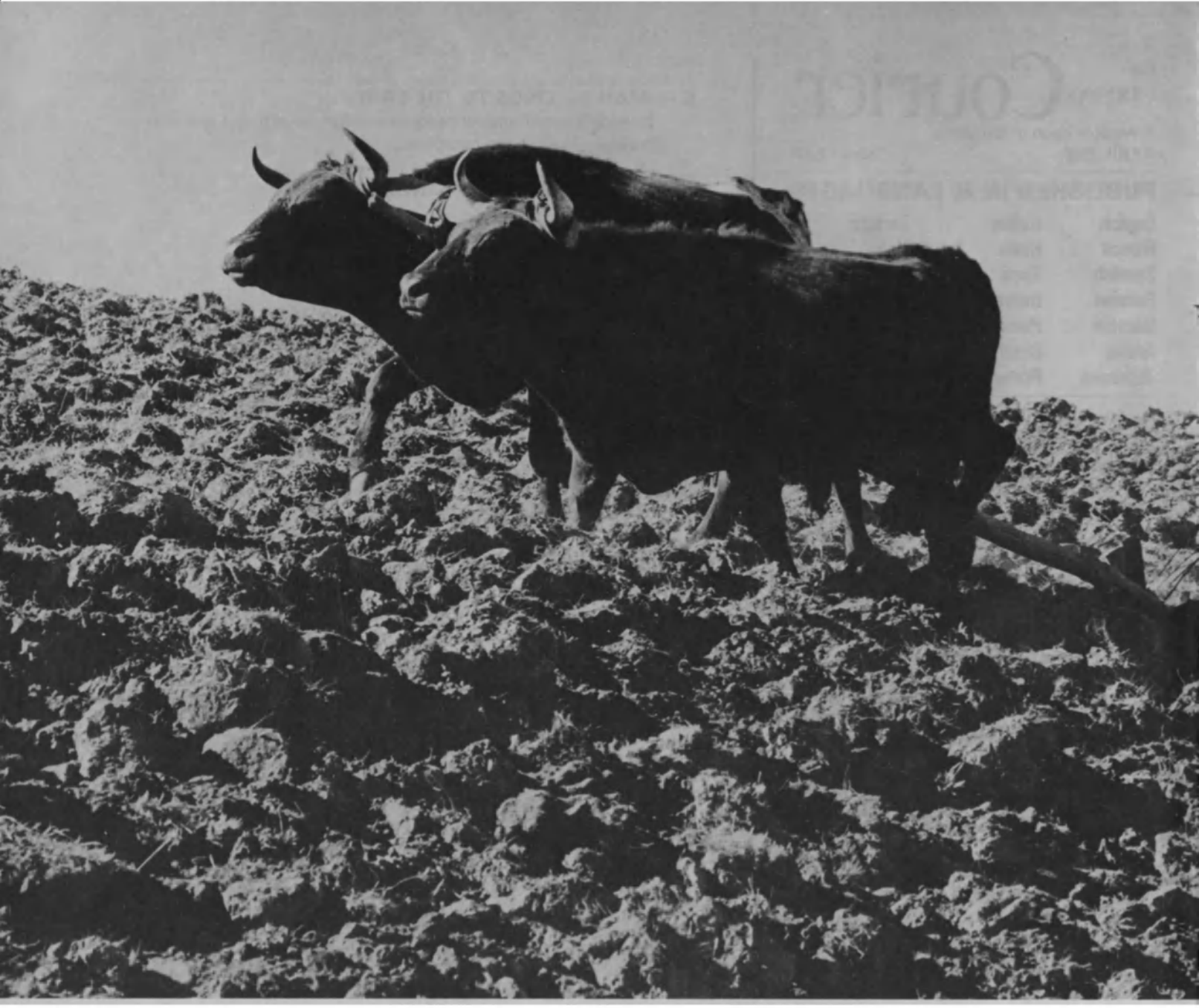
The Unesco Braille Courier

Unesco's magazine for the visually handicapped, formerly published twice a year as the *Unesco Braille Review*, is to be published quarterly from this year as a prelude to the Organization's programme for the International Year for Disabled Persons, 1981. Under the new title of the *Unesco Braille Courier*, the only magazine for blind people published within the United Nations system will contain specially selected articles from the *Unesco Courier* and will be produced in English, French and Spanish. The March 1980 issue is already available.

Cover

This peaceful scene of a Bolivian shepherd in the midst of his flock of llamas and sheep high up in the Andean altiplano masks a less than idyllic reality. Case studies published in this issue of the *Unesco Courier* on the Andes, an Alpine village and islands in the Pacific and Mediterranean show how rapid population growth, migration and the pressures of mass tourism can upset even a long-established environmental and social balance. Other themes include: the impact of the ideas of the Bauhaus, the school of design, art and architecture founded some sixty years ago in the Weimar Republic; computer music; and, discrimination against girls in access to schools and the part played by the school in perpetuating traditional attitudes to sex-roles.

Photo © Gisbert Glaser, Paris



'Man belongs to the earth...'

Photo Maximilien Bruggmann © La Spirale, Lausanne, Switzerland

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A century and a quarter ago, Chief Sealth of the Suquamish Indians rebuked white emissaries who offered to buy his tribe's land with the words: "The Earth does not belong to man; man belongs to the Earth".

That was in 1854. Since then the world's population has increased by some two thousand two hundred and fifty million and at current rates will reach six thousand million by the year 2000.

Until recently, man and his activities could be considered as just one among the many natural processes that are continually modifying the state of the biosphere, that thin envelope of soil, water and air surrounding our planet to which all life is confined. Today, however, in the words of the late Professor Vladimir Vernadsky, world-famous Soviet earth scientist, "humanity as a whole has become a powerful geological force". Changes which have occurred in the biosphere over recent decades as a result of accelerating human activity are comparable in scale with natural changes occurring over periods of millions of years.

The problem now is how, given this increasing human pressure, can productivity be maintained and enhanced not only for today but for future generations as well. The time has come for man to make rational use of the natural resources of the biosphere.

A number of difficulties arise, however, when, having recognized the problem, we attempt to do something about it. For though, over the years, scientists have accumulated a vast store of knowledge about the individual components of the biosphere, the traditional specialized approach to scientific research has meant that the complex interrelationships and interactions between these components have largely been ignored. Walking the lonely road of specialization, the scientist has contributed a very great deal to human well-being and progress, but this progress has been uneven. A new integrated, global, interdisciplinary approach to research is needed if the biosphere, man's life-support system, is to be properly managed.

The promotion of this new approach to research is at the heart of Unesco's Man and the Biosphere (MAB) Programme, which was set in motion early in the 1970s.

The general objective of this Programme has been defined as: "... to develop within the natural and social sciences a basis for the rational use and conservation of the resources of the biosphere and for the improvement of the relationship between man and the environment; to predict the consequence of today's actions on tomorrow's world and thereby to increase man's ability to manage efficiently the natural resources of the biosphere".

Under the MAB Programme, the emphasis of research has shifted from intensive scientific examination of individual topics towards examination of all the variables and all the processes involved in an ecological unit or ecosystem—a kind of self-contained, self-supporting microcosm of the greater world.

The specific aims of the Programme are:

- To identify and assess the changes within ecosystems resulting from man's activities and the effects of these changes on man.
- To study and compare the structure, functioning and dynamics of natural, modified and managed ecosystems.
- To study and compare the dynamic interrelationships between "natural" ecosystems and socio-economic processes and especially the impact of changes in human populations, settlement patterns and technology on the future viability of these systems.
- To establish scientific criteria to serve as a basis for rational management of natural resources.
- To establish standard methods for acquiring and processing environmental data.
- To promote the development of simulation and other techniques of prediction as tools for environmental management.
- To promote environmental education in its broadest sense and encourage the idea of man's responsibility for and personal fulfilment in partnership with nature.

The MAB Programme consists of fourteen project areas, but these by their very nature are inevitably overlapping and interlinked. They include the main ecological systems and physiological units: tropical forests; temperate and Mediterranean-type forests; grazing lands (savannah, grasslands, etc.); arid and semi-arid zones; lakes, marshes, rivers, deltas, estuaries and coastal zones; mountain and tundra lands; and island ecosystems. Man-made as opposed to natural ecosystems and man's use or abuse of energy are also covered as are four major fields of human activity or interaction with the biosphere: conservation of natural areas, effects of pesticides and fertilizers, major engineering works, and genetic and demographic changes. Study of our perception of environmental quality views the global problem with the aim of providing criteria for the value judgements which the programme necessarily entails and there is provision for research on environmental pollution and its effect on the biosphere.

How does MAB work? Underlying the Programme are three concepts on which its approach to research is based : MAB is intergovernmental in structure, it is problem-oriented and it is interdisciplinary.

MAB is intergovernmental for the obvious reason that environmental problems do not stop at national boundaries; regional and global solutions must be found for those problems which were formerly tackled piecemeal within the national context only. The Programme is controlled by an International Co-ordinating Council consisting

of the representatives of the ninety-five member countries sitting together with representatives of the United Nations organizations concerned—Unesco, the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO) and the World Meteorological Organization (WMO) —as well as representatives of the International Union for Conservation of Nature and Natural Resources (IUCN) and the world scientific community as represented by the International Council of Scientific Unions (ICSU). Unesco provides the general secretariat. Each country's contribution to the Programme is the responsibility of a National Committee consisting of scientists from universities and research institutions sitting alongside government representatives.

This is extremely important for the problem-oriented approach to research, since it means that the government officials, who make the decisions, are involved from its very inception in the formulation and carrying out of research. It means that research is designed to provide the information on which decisions can be based. Instead of building a dam, for example, and then asking the scientist to assess its effects on the environment, the question now put to the scientist is "What would happen if we were to build a dam?"

This kind of approach necessarily implies the third concept of interdisciplinarity. It would be useless to ask only hydrologists the question "what would happen if we were to build a dam?" Such factors as the effect on local populations, on their health, on food production, etc..., demand that social scientists', medical scientists' and agronomists' views be also taken into consideration before any decision to build a dam is taken.

On almost any problem of this kind scientists from several disciplines will necessarily be involved, but there are considerable practical difficulties in creating interdisciplinary research teams and integrating fully the results achieved. For example, the social scientist concerned with population effects may need to study migration trends over a number of years, whereas a botar ist may be interested in changes in the output of a plant community over the period of a single growing season. In fact, for interdisciplinary research to succeed, each research worker must learn to adapt to the methods and requirements of other disciplines and this is never easy.

Unesco's role in all this is to stimulate and co-ordinate research and to provide organizational support to the teams of experts now carrying out MAB projects throughout the world.

The ultimate human goal of the MAB Programme implied by the concept of rational use of the resources of the biosphere is twofold: the achievement of development and a high standard of living for all men coupled with the safeguarding of the world's natural resources and genetic stock so that future generations will have as many evolutionary options open to them as possible. Man is the steward of posterity. He must recognize his true position in the order of things and come to terms with the environment of which he is a part. "The Earth does not belong to man; man belongs to the Earth". ■

Highlands and Islands

Ecosystems in danger

by Francesco di Castri and Gisbert Glaser

IN the fascinating kaleidoscope of peoples and cultures that make up our world highlanders and islanders stand out as a breed apart, characterized by a fierce independence of spirit and a profound attachment to their place of origin.

For the islander the physical barrier of the sea acts as a permanent reminder that he is distinct from the man of the mainland, cut off from easy access to many of the resources readily available to his continental counterpart and untouched by the cultural waves that ebb and flow ceaselessly across land frontiers.

In the fastnesses of his upland home, those mountains that rise like landlocked islands from the continental plains, the highlander too is often so cut off from the plainsmen below that, even in today's world of instant communication through radio and television, his cultural patterns retain their distinctive forms.

But independence of spirit born of isolation is not all that unites highlanders and islanders. The peoples occupying these microcosmic areas have shaped some of the most harmonious landscapes in the world, often achieving an equilibrium, a partnership with nature, that has lasted for centuries. Today, in a shrinking world, from the Alps to the Andes and from the Mediterranean to the Pacific, the pressures of population growth and movement and the demands of development have placed this equilibrium in danger.

For scientists working within the framework of Unesco's international research undertaking, the Man and the Biosphere (MAB) Programme (see article page 5), islands and highlands offer ideal fields for research on the interactions between ecology and development. Being small, relatively clearly defined units, the forces and interactions that affect the complex man/environment relationship can be fairly readily identified and modelled and the lessons learnt applied to other larger and more intricate systems.

In two of the mountain areas and two of the island ecosystems in which MAB research teams have been working—the Andes, the Alps, the Tunisian island of Djerba in the Mediterranean and the Fiji Islands in the Pacific—population movements of various kinds have been the underlying cause of instability and environmental change.

For many centuries, human habitation in the central Andes was concentrated mainly in the altiplanos, or high plateaux, with settlements spanning the range from isolated rural communities to large urban centres. The adjacent downslope areas were more sparsely settled, particularly the tropical forest areas in the lowlands west of the Andes. During this century, and especially since 1950, there have been great movements of population to the urban areas in the mountains, to the lower altitude areas and, above all, to the coastal towns and cities.

Emigration from the highland areas results in part from growing population pressure on a limited resource base and in part from a real or an expected better quality of life in other areas. For a variety of social and political reasons the patterns of land exploitation established in the altiplanos after the Spanish conquest remained static and when faced with rapid population growth the capacity of the highland areas to support ever-increasing numbers was rapidly stretched to the limit. The result was over-use of land, particularly over-grazing, a decline in productivity in many areas and a consequent increase in emigration, especially among the younger and more dynamic people.

Migration on the scale now being experienced in the Andes affects the environment through over-use in some areas and under-use in others. Another consequence has been that for the first time in history the downslope areas below the altiplanos are being massively exploited. Unfortunately, lack of sound agricultural practice is leading to accelerated erosion of the soil which not only affects the productivity of these areas directly but also has a negative effect on lowland areas.

Migration is also putting serious pressure on the housing and health services and other amenities in the urban areas, especially in the coastal towns and cities to which the population flow is the greatest. The health problems are enormous since the altiplano populations arriving in the humid low altitude areas are especially vulnerable to bacterial, viral, parasitic and microbial infections against which they have no natural immunity.

In the Alps, population movement has been in two directions. The traditional mountain populations are abandoning some of the higher altitude areas, while adjacent lower areas are becoming comparatively crowded. But the main cause for concern is the transformation of what was formerly a relatively stable agricultural and pastoral system due to seasonal inflows of people from outside the area on such a vast scale that the carrying capacity of these areas may well be exceeded.

These inflows are made up of summer and winter tourists and weekend visitors from the densely populated neighbouring regions. To these must be added owners of second homes who often become permanent residents upon retirement. Many traditional villages, Alpine pasturelands and, indeed, whole valleys can no longer meet the demands of this additional population for avalanche-safe building land, water, roads, energy supplies, ski-lifts and ski-runs. There is also the risk that excessive population concentration may lead to water, air and land pollution.

Certain areas may risk losing their attraction for summer tourists if landscapes are more marked by ski-lifts and ski-run erosion than by the beauty of the traditional Alpine landscapes, and even winter tourism will be discouraged if the areas become too crowded, too built-up and if traffic on the mountain roads rivals that in the towns.

Agriculture, too, is very much affected—not only in tourist areas but throughout the Alpine region. New attitudes towards agricultural work and rural life are as important as the profitability of agricultural and pastoral use of steep and isolated mountain lands in provoking the abandonment of certain areas or the appearance of phenomena such as undergrazing. As fewer and fewer pathways for the herds remain available the old practice of transhumance (the moving of cattle from winter to summer pastures) is disappearing in the western Alps. One immediate side effect of this abandonment of grazing land is that changes in the vegetation cover create surfaces more conducive to avalanches.

The direct effects of the massive increase in the numbers of skiers over the past decade must also be taken into account. Aerial photographic surveys have shown how much the impacting of snow by thousands of ski descents every winter hinders the run-off of water in the spring. Vegetation is destroyed by the cutting edges of skis and it has been found that along the ski runs the insect population is decimated and the number of earthworms per square metre along some trails, scientists have discovered, has been reduced from 130 to ten.

Tourism has also been one of the major causes of change in many Mediterranean islands. The impact of the mass tourist industry has upset the balance of what were once relatively self-sufficient, traditional agricultural and pastoral systems.

On the Tunisian island of Djerba, for example, the traditional system was already not fully self-sufficient, as emigration was always extensive, and remittances from rich emigrants in Tunis or even further afield have played a major role in keeping the economic system functioning, and in maintaining a standard of living which is higher than that in most other areas of Tunisia.

Large-scale tourism was introduced only in the late 1960s. During the peak tourist seasons of the last few years, the number of visitors on the island has been twice that of the native population. The needs of these tourists for hotel accommodation, water, food and services, and their contacts with the local population, have modified the environment, the land-use systems, the overall economy, the physical infrastructure, the society, the maintenance of cultural traditions and the aspirations of the people of Djerba.

Major problems arise from the competition between agriculture and the tourist industry for the two main limiting resources,

Photo Mossdorf © A.A.A., Paris

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Below right, the spreading outskirts of La Paz, Bolivia, the world's highest capital (3,577 metres above sea level). Growing population pressure on the limited resources of the rural areas of the Andean altiplanos, or high plateaux, is leading to increasing migration to the towns. Bolivia has no coastline, but in other Andean countries the main pattern of migration is from the high rural areas to the high urban areas and from the high urban areas to lowland and coastal towns. Right, harvesting the potato crop in the department of Ayacucho in the highlands of south central Peru.

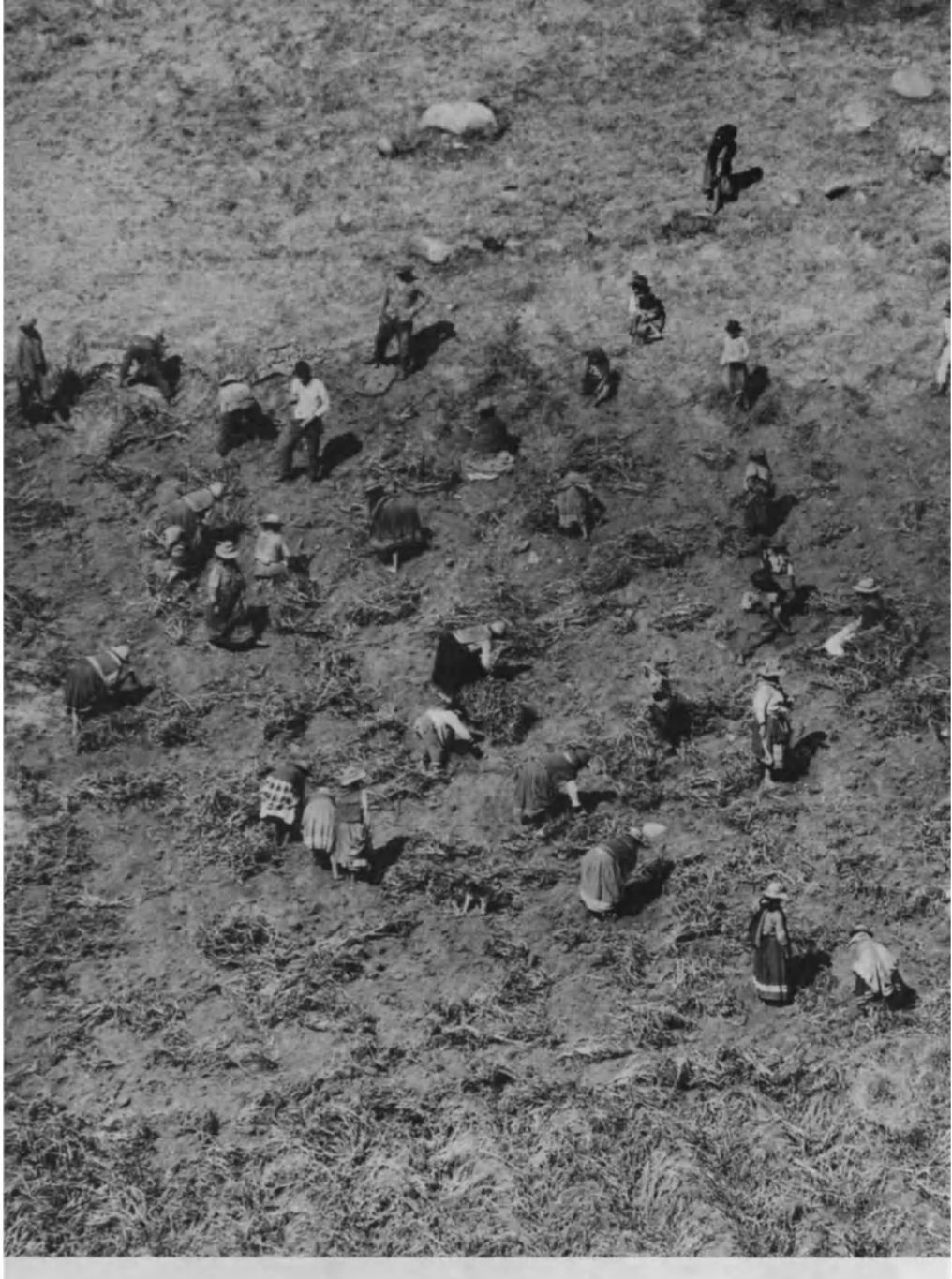


Photo Maximilien Bruggmann © La Spirale, Lausanne, Switzerland

Photo Silvester © Rapho, Paris

water and labour. The risk of under-use of the land, with all its ecological consequences, cannot be ignored, given the changing attitudes towards agricultural work. Under these circumstances, agriculture and pastoralism require special support and guidance.

The socio-cultural impact of tourism may well be the cause of the most serious problems at the present time. The sudden "confrontation" of a traditionally rural, mainly Islamic society with "liberalized", mainly urban Western Europeans, their lifestyle and their money, may lead too abruptly to changes in attitudes and cultural identification within the local society.

Another important problem is the transformation of the traditional Djerbian landscapes through these new developments. Tourists come, not only in search of sunshine and beaches, but also of the remnants of this traditional landscape and the traditional life-style.

Although their population is small in numerical terms, the outlying eastern islands of Fiji appear to have more inhabitants than they can at present support. The situation in which they find themselves is common to many other tropical islands and, indeed, to many rural areas in the developing world. Typical of this situation is the use of land to produce a single crop for export (in the case of Fiji this is copra) which is in economic decline because of falling world market prices, at the expense of food production for the subsistence of the island populations.

Inter-island produce exchange in Fiji has virtually disappeared and the network of flows of materials and people between islands has almost completely collapsed. With the decline in demand for copra, fewer and fewer ships call on them and they become more and more isolated. The response to this situation is increased

Each year, the 300 inhabitants of the Austrian Alpine village of Obergurgl (below) act as hosts to 40,000 tourists. On the Tunisian island of Djerba (bottom), situated in the Gulf of Gabès and known to the ancients as the "land of the lotus-eaters", tourists outnumber the approximately 11,000 islanders by two to one at the height of the holiday season. Although large-scale tourism has brought economic advantages to these areas, it threatens to upset both their environmental equilibrium and traditional life-styles.

Photo F. Ainsa, Unesco

Photo Perez © Rapho, Paris

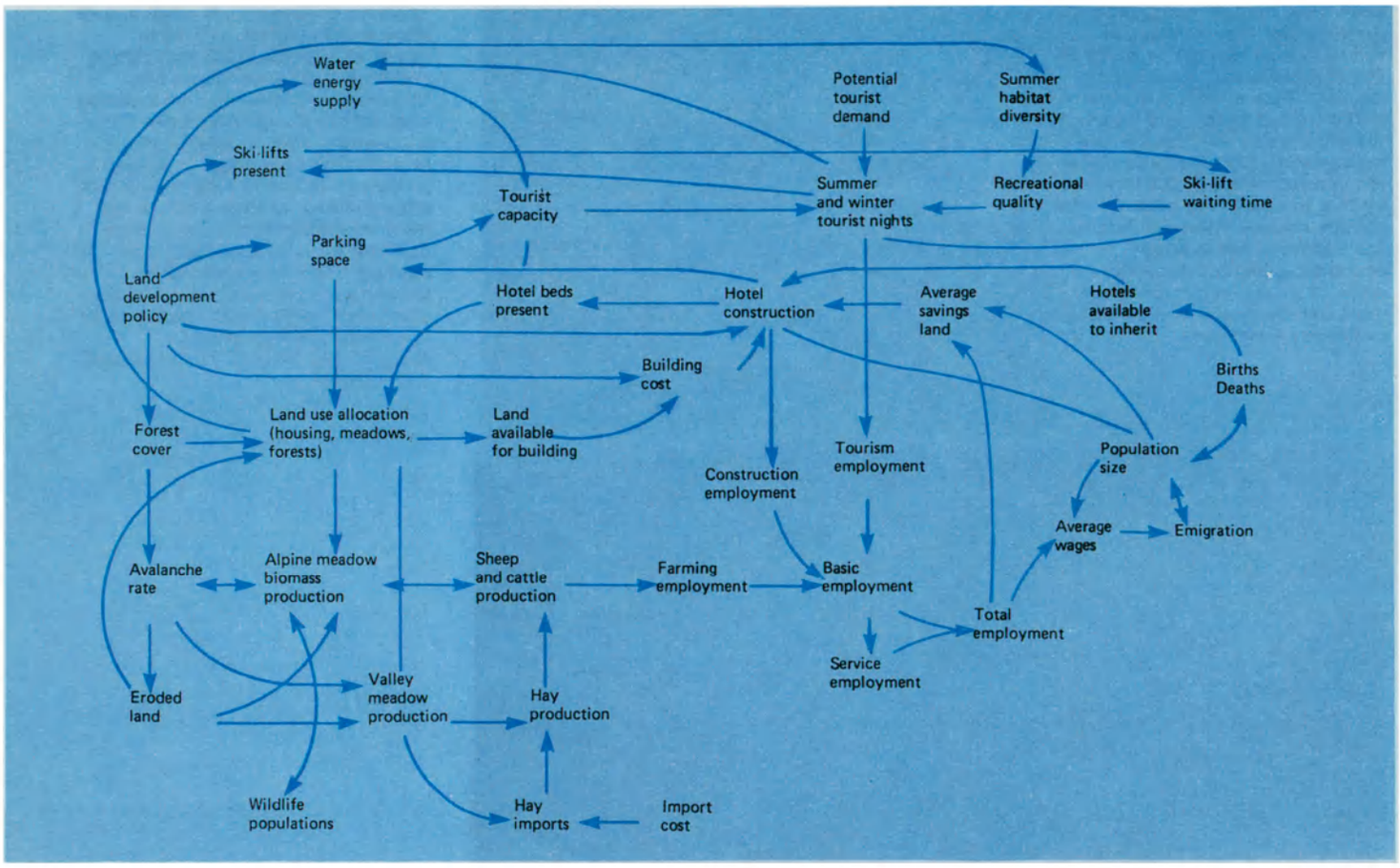
emigration to the larger islands or to continents where the economic growth centres are.

Thus, while the outer islands are underused, the main islands are no longer self-sufficient in food production and food imports are increasing. In Fiji, the size of the population flows to the two major islands of Viti Levu and Vanua Levu, and especially to the capital area, Suva, has become so great that housing, employment and schooling needs can no longer be met.

Have the Unesco/MAB researchers any solutions to offer to the decision-makers who have to cope with the kinds of problems outlined above? The answer is that in the two cases where their research is nearing completion they certainly have.

The village of Obergurgl, at the head of the Oetz valley in the Austrian Tyrolean Alps faces many of the problems affecting Alpine areas described above. Situated at an altitude of about 2,000 metres, the village draws an ever-increasing number of summer and winter tourists. The first signs of the environmental consequences of this "development", expressed largely in terms of hotel and ski-lift construction and a sharp increase in the presence of people (and cars) in the village and its surroundings, are beginning to appear. The people of Obergurgl (300 inhabitants) perceive these as negative, and fear that eventually tourists might stay away from their village because they no longer find it attractive. Another potential limit to this type of economic growth is simply the availability of avalanche-safe land.

The MAB National Committee of Austria, following proposals put forward by researchers of the University of Innsbruck and working in collaboration with the International Institute of Applied Systems Analysis in Laxenburg, Austria, chose Obergurgl as a site for intensive study.



Diagram, above, shows the many interlinked factors which have to be taken into account in planning for the balanced development of even a small, well-defined community like the village of Obergurgl in the Austrian Alps. Alteration of any one of these factors may have complex and sometimes unexpected repercussions on the others. To take the simple example of ski-lift waiting time—if winter visitors have to queue up for more than a certain length of time, they will stay away in future years; if more ski-lifts are built, more winter tourists will come, and more hotels will have to be built, thus reducing the land available for cattle grazing and the production of forage; summer tourists will stay away as the scenic attractions of the area are increasingly marred by unsightly ski-lifts and additional building; summer employment in tourism will fall and emigration will increase. The study of Obergurgl undertaken by the Austrian National Committee for Unesco's Man and the Biosphere (MAB) Programme, in collaboration with the Institute of Applied Systems Analysis, Laxenburg, set an example in that the population of Obergurgl was consulted and involved at every stage of the investigation.

Diagram from *Alpine areas workshop on the Obergurgl model* by Franz and Holling © IIASA, 1974, Laxenburg, Austria

The disciplines working together in this project include meteorology, botany, zoology, microbiology and pedology, as well as economic geography, anthropology, sociology, regional planning sciences and economics. The great success of the project lies, however, in the fact that it was possible to involve in its work not only the research workers, but also those actually concerned by the research and in need of the information generated by it.

In fact, since its beginning in 1973, the project has provided a framework for a permanent dialogue and feedback mechanism between the local population, local political representatives, the village administration, the Tyrolean government and the research workers.

Thus, the three different dynamic models of Obergurgl which have been developed in successive stages of the project combine the insights and knowledge of scientists and of the people of Obergurgl. The first model was a preliminary attempt to show human impact on a simple mosaic of Alpine ecosystems, and the policy options available. It dealt with recreational demand predictions, population growth in relation to alternative economic development, farming and environmental change, animal population patterns, forests and the rates of avalanche and erosion. The model allowed the simulation of predictive scenarios of alternatives for the development of Obergurgl in the coming twenty to forty years, and their constraints.

Obergurgl Model II enriched Model I with the results of various concurrent scientific and anthropological studies such as the determination of thresholds of necessary environmental disturbance before erosion occurs, and the weighting of the factor of landscape quality by tourists and local populations. Both models, however, represented the very particular situation of Obergurgl, and were not easily transferred to other geographical areas in the Alps. Model III was developed for transferring results to other regions. It is based on the investigation of the types of changes which occur in the major types of ecosystems and physical terrain under different degrees of environmental stress and forms of use (grazing, skiing, etc.). Thus, by simulating the environmental consequences of various development alternatives, Model III provides a useful and widely applicable planning instrument

In Fiji, with financial assistance from the United Nations Fund for Population Activities (UNFPA), Unesco-MAB conducted a pilot research project with a broad interdisciplinary approach.

For about two years, from 1974 to 1976, field studies were undertaken in Fiji, concentrating on the systems relations between: (a) human population dynamics; (b) use of natural resources from a set of interlinked ecosystems ranging from marine to coastal and terrestrial; (c) the function of the few outer islands in eastern Fiji which were studied, in relation to national and global economic development structures.

By integrating the various component studies the project has been able to formulate suggestions for more rational management of the resources of the outer islands. For the farmers of the outer islands, the economic reward of coconut growing is, in cash terms, far smaller than that of the Fiji-consumed taro, and yaqona is even more lucrative.

A first suggestion is that the agricultural production of the islands relatively close to

the urbanized areas of Fiji in Viti Levu and Vanua Levu be developed so as to be wholly absorbed into the national market. For the more distant islands, a mix of export production and supply to the national market should be envisaged.

The project also provided detailed recommendations on the potential diversity of land and sea use, including development of pine schemes and methods of aquaculture for more intensive fish production.

Programmes to increase rural incomes, expand employment opportunities, and improve the quality of life in rural areas would reduce the rate of urban immigration and alleviate problems in the urban areas of the two largest islands. The project analysed the possibilities for this change and developed alternative scenarios for the future.

It was, of course, not sufficient to study various outer islands in isolation. Emphasis had to be laid on the study of the flow of material and people, political influence/decisions, etc., among these islands and between the islands under study and the outside world, mainly the two major islands of Viti Levu and Vanua Levu.

This approach alone made it possible to consider important questions related to population carrying capacity. Are these islands overpopulated? Can they carry more people than they do now? Alternatively, is a shortage of people likely to become critical as a limitation to development?

A methodology has been developed to calculate the carrying capacity of these islands under different human use systems. Surprisingly, results show that the outer islands are underpopulated for other types of land use. Even the number of people that could be supported at minimum recommended standard-of-living levels in a pure subsistence economy would be far higher than the present population, under a copra economy in decline. In fact, most of the islands under study could support larger populations if their economies were based on more diversified and rational use of the land.

MAB research findings are now helping to shape the decision-making process at Obergurgl and in the Fiji Islands. But, more than this, they are helping to solve the problems of other mountain tourist areas and other island groups. For although both projects involve very specific local problems, every MAB project is designed to provide "core" material applicable to other regions. The research methods evolved during the Fiji project, for example, are already being used in a current study of Caribbean islands, and the Obergurgl study led to the development of a model applicable to many other Alpine regions under environmental stress as a result of changing agricultural practices and the pressure of tourism.

Altogether some 950 MAB research projects of all kinds are now in progress. Research findings are being fed into a computerized information system and a body of basic information on appropriate methods for handling environmental and resource-use problems is gradually being acquired which is freely available to decision-makers the world over. The MAB dream of a world in which man lives in partnership with nature making rational use of the natural resources of the biosphere is slowly but steadily becoming a reality.

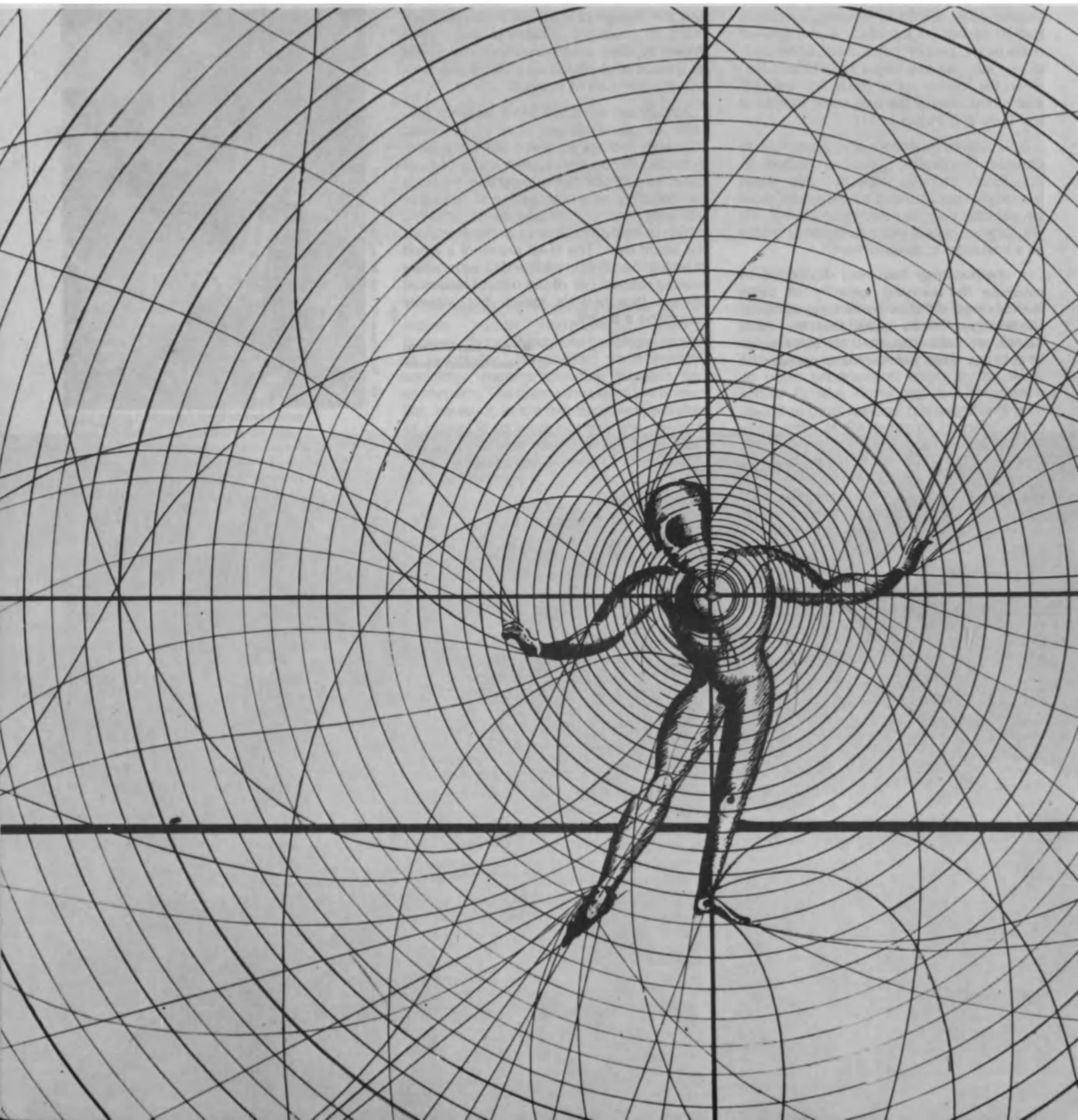
■ **Francesco di Castri and Gisbert Glaser**

Below, a Fiji islander tends a taro plant. The taro's large, starchy, spherical underground root forms the staple food of many Pacific island peoples. The Unesco/MAB study on Fiji suggests that it would be advantageous for the farmers of some of the outer islands to increase production of taro for consumption by Fijians and to reduce production of copra for export. Bottom photo, a typical cluster of outer Fijian islands.

Photo Paul Popper © Atlas Photo, Paris

Photo Griffiths © Magnum, Paris

THE BAUH



AUS (1919-1933)

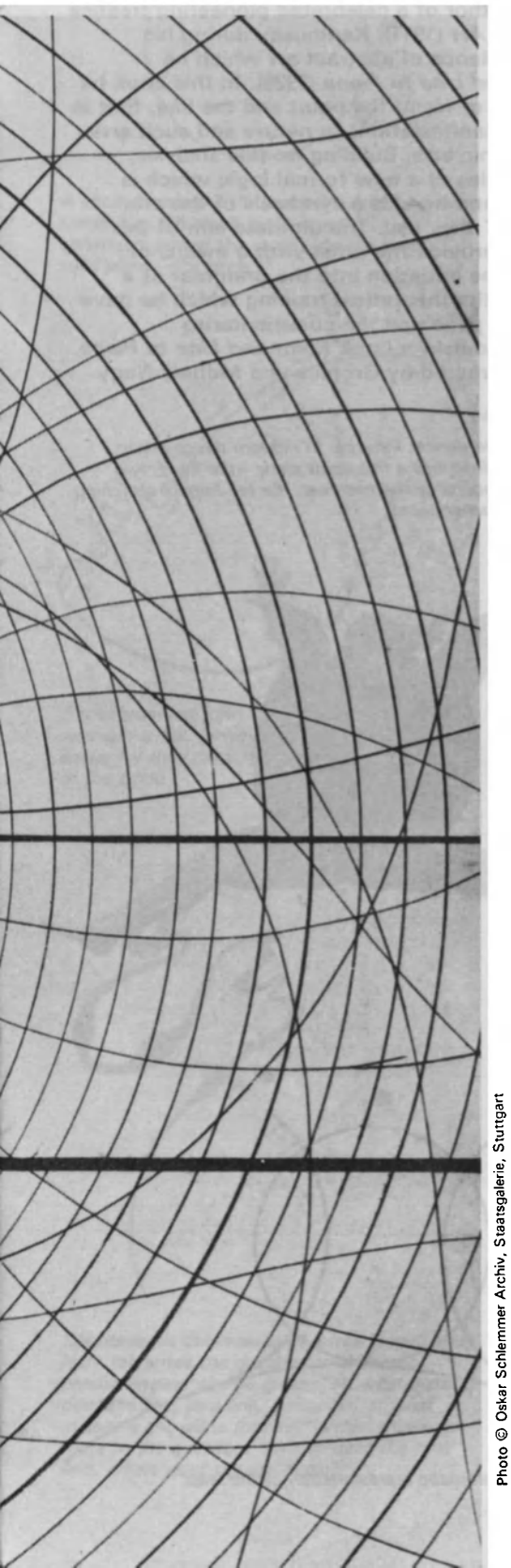


Photo © Oskar Schlemmer Archiv, Staatsgalerie, Stuttgart

"Egocentric Outline of Space" by Oskar Schlemmer (1924)

Design for living in the modern world

The Bauhaus, the school of design, art and architecture founded by Walter Gropius sixty years ago at Weimar (Germany), has had a seminal influence on the environment modern man has created for himself. Its impact on the design of buildings, furniture, typography, household goods, tools and many other articles in everyday use, extended far beyond its native Germany for when the school finally closed down in 1933 after the Nazis came to power, its leading staff members and students emigrated and carried its message to many other countries.

What was this message? For Gropius, the school's "specific mission was the realization of a modern architecture which, like human nature, should be all-encompassing". Gropius proclaimed the unity of the arts, obliterating the traditional distinction between artisan and artist and seeking to forge new links between industrial mass production, the crafts, the sciences, the creative forces of the time and the eternal laws of materials. He wished, he wrote later, "to draw the creative artist from his ivory tower, to bring him back to the world of everyday reality". Under his direction the Bauhaus studios became laboratories where prototype designs for industry were developed. "Although these prototypes were hand-made", he wrote, "their creators had to be completely familiar with methods of industrial production; and so the Bauhaus sent its best students to work for a time in factories during their studies".

One facet of Gropius's genius was that he attracted to the Bauhaus as teachers some of the most outstanding European artists of his time. These were, Gropius noted, "not men who would behave like musicians in thrall to the conductor's baton", and throughout its lifetime the Bauhaus was in fact a ferment of debate as these great figures wrestled with the problems of finding a "truer relationship between form and function, form and material, form and production methods". On pages 14 to 17 we attempt to give the general reader a glimpse of the teachings on the "elements of form" developed by two of these artists, Wassily Kandinsky and Paul Klee, while they were instructors at the Bauhaus. Pen drawing at left by Oskar Schlemmer is another reminder of the school's all-embracing ambitions and preoccupations. It arose out of the course on man which Schlemmer taught from 1922 to 1929 and whose goal was, Schlemmer noted, nothing less than to familiarize the student "with man in the totality of his being". "The relationship between man's dimensions and the outside world", wrote Schlemmer, "constitutes an initiation into the problems of housing and its disposition."

From the moment when it was created in the climate of limitless hopes and possibilities which prevailed in Europe at the end of the First World War, the Bauhaus has never ceased to generate controversy. The article by Claude Schnaidt on page 18 is a new contribution to this endless debate about an institution whose purpose in its founder's words was "not to propagate any style, system or dogma but to exert a revitalizing influence on creation".

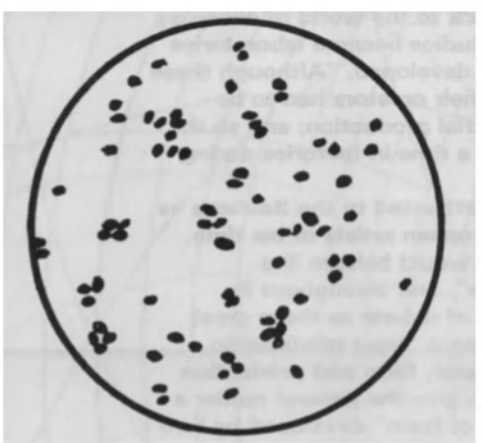
Kandinsky at the Bauhaus

The grammar of a visual language

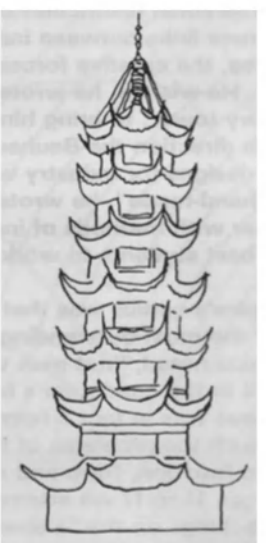
Wassily Kandinsky (left) with Paul Klee, at Hendaye, France, in August 1929.

Photo © Bildarchiv Felix Klee, Bern, Switzerland

"The drawing course at the Bauhaus is an education in perception, teaching precise observation and representation, not of the external appearance of objects but of the elements of which they are constructed, their laws of tension... "This was the guiding principle followed by the Russian painter Wassily Kandinsky (1866-1944), one of the great innovators and theorists of non-figurative art, in the analytical drawing course which he taught at the Bauhaus, where he was a professor from 1922 to 1933. Already the author of a celebrated pioneering treatise on abstract art, *Concerning the Spiritual in Art* (1911), Kandinsky during his Bauhaus years evolved a comprehensive science of abstract art which he presented in a major work entitled *Point and Line to Plane* (1926). In this book he rigorously analyses the two basic elements of form, the point and the line, first in abstract terms and then in their different manifestations in nature and such arts as architecture, dance, music and the graphic arts. Building on this analysis, Kandinsky goes on to formulate the principles of a new formal logic which is based on the inner "resonances" of forms and heralds a synthesis of the arts through the equivalence of the "languages" they use. The ultimate aim of this new science, as Kandinsky saw it, was to provide the artist with a means of mastering his creation, and consequently the initiation into the grammar of a visual language held an important place in the theoretical training which he gave at the Bauhaus. Illustrations on this double page and the commentaries accompanying them are all taken from Kandinsky's book *Point and Line to Plane*, published in the "Bauhaus Books" series directed by Gropius and Moholy-Nagy.

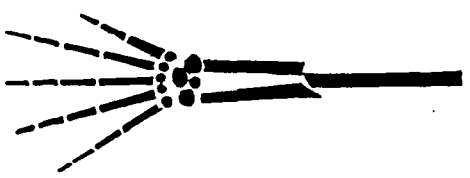


A nitrite formation magnified a thousand times. We can also consider the entire "world" as a complete cosmic composition, itself composed of an infinite number of smaller and smaller autonomous compositions, all of which are finally composed of points, both in the macrocosm and in the microcosm, which, moreover, brings the point back to its original geometric state.

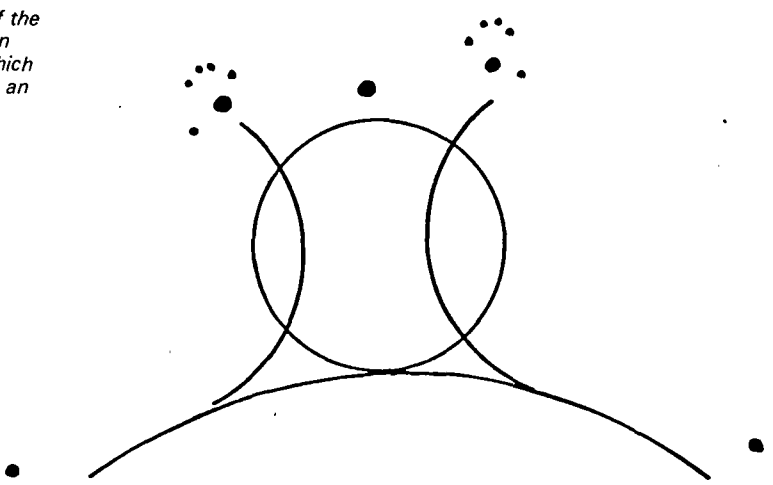


The Beauty of the Dragon pagoda, in Shanghai (built in 1411). It is precisely in these constructions that we can assume a conscious use of the point, since it is manifest in deliberate compositions which stretch out the volumes to an ultimate point.

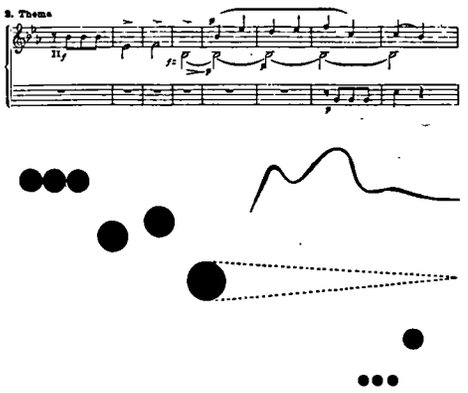
A leap by the dancer Palucca. In modern dance a leap sometimes describes a five-point plane—the head, two hands, the points of the two feet, the ten fingers sketching ten other smaller points.



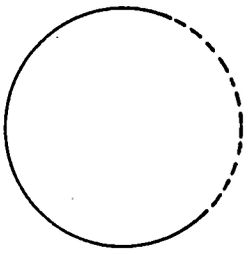
Diagrammatic representation of an extremity of a vertebrate. Completion of the central construction. The growth of a finger on the hand is like that of a twig which grows on a branch—according to the principle of a gradual development starting from the centre.



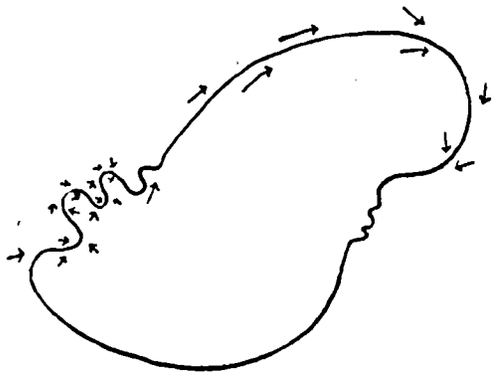
Diagrammatic representation of the leap.



A musical theme expressed in points.



A circle forming. If the point is pushed by two forces (...) the result is the most ephemeral and at the same time the most solid plane—the circle.



Planes resulting from curves (...) always maintain a link, however imprecise, with the circle, for they carry within them the tensions of the circle.

Spontaneous thickenings of a free curved line. Here too arises the question to which no precise answer can be given: "At what instant does the line, as a line, disappear, at what instant is the plane formed?" What answer is there to the question: "Where does the river end, where does the sea begin?"

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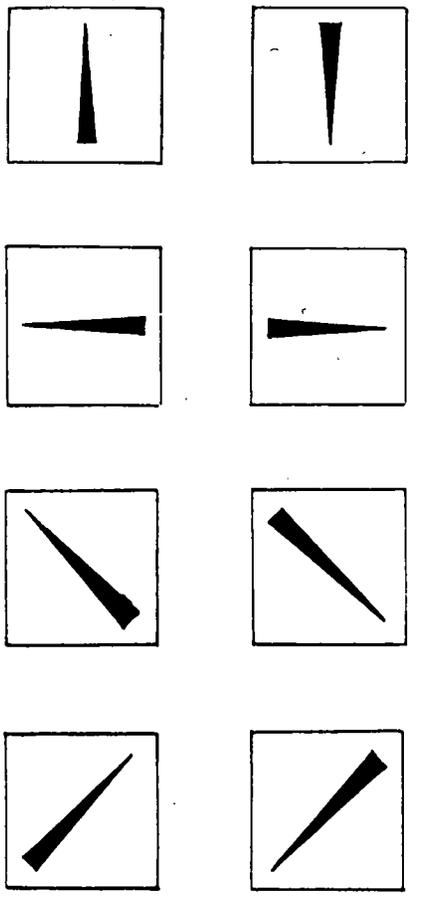


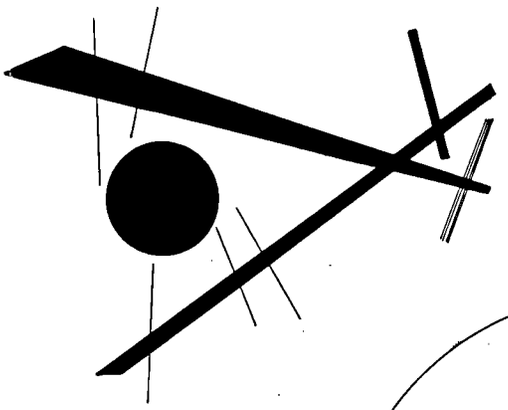
Every space within the original plane (by original plane is meant the surface on which the work is executed) is individual, with its own sonority and interior coloration.

A I Vertical position "calm hot".

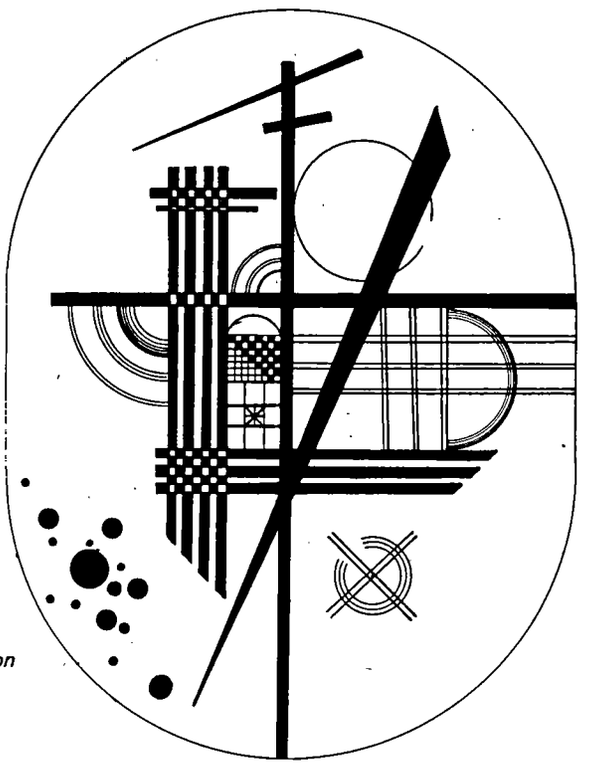
A II Horizontal position "calm cold".

B I Diagonal position "discordant".

B II Diagonal position "harmonious".



Line.
With the point
at the limit of the plane.



Line.
Horizontal/vertical construction with opposed diagonal and tension of points
—sketch of the painting "Intimate Message" (1925).

Klee at the Bauhaus

The linear logic of fantasy

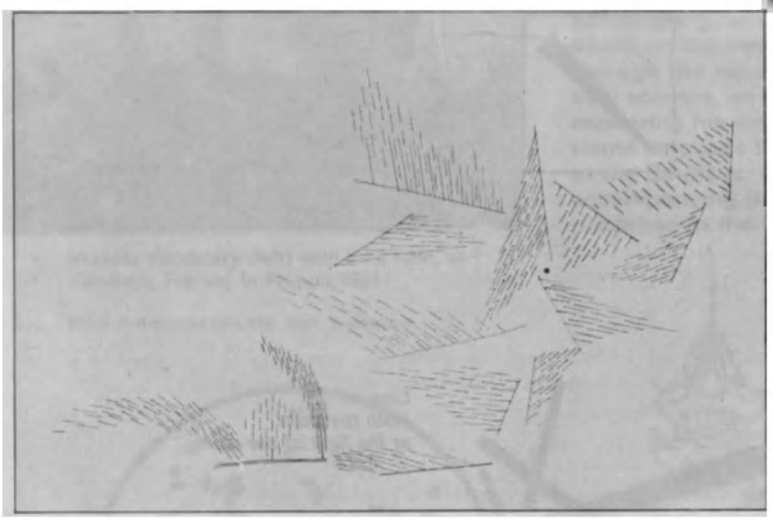


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Photo Paul Klee Foundation, Kunstmuseum, Bern © Cosmopress, Geneva, and ADAGP, Paris

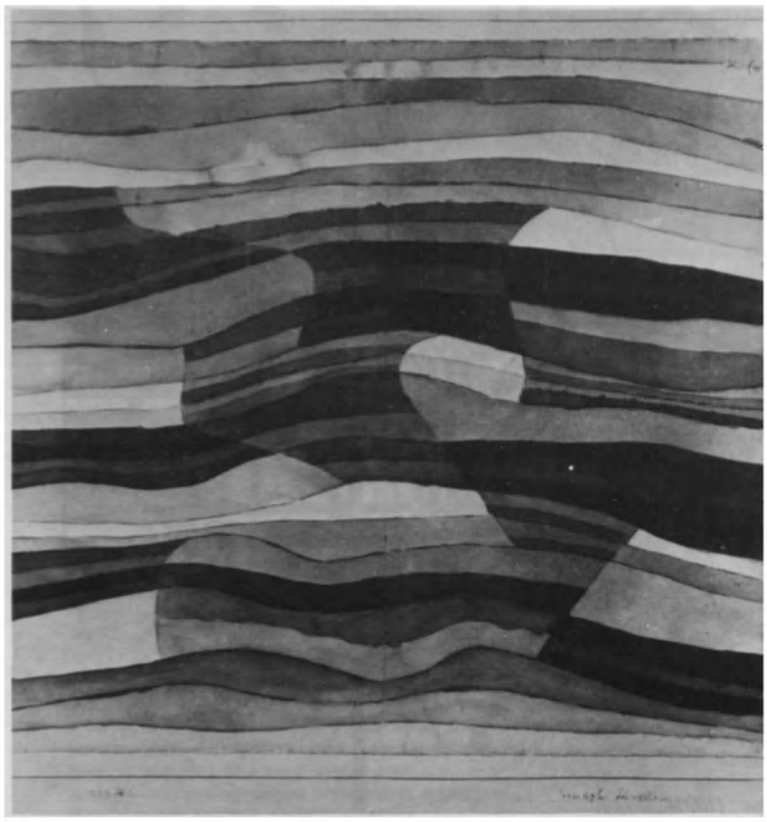

Photo Felix Klee, Bern © Cosmopress, Geneva, and ADAGP, Paris

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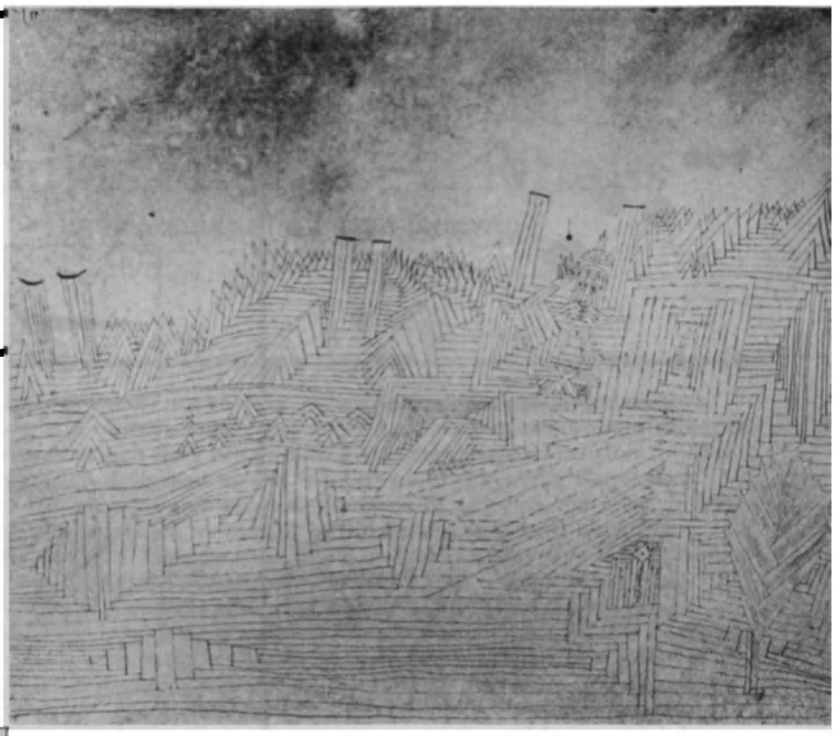


Photo Felix Klee, Bern © Cosmopress, Geneva, and ADAGP, Paris. L. S Rosengart Collection. Lucerne

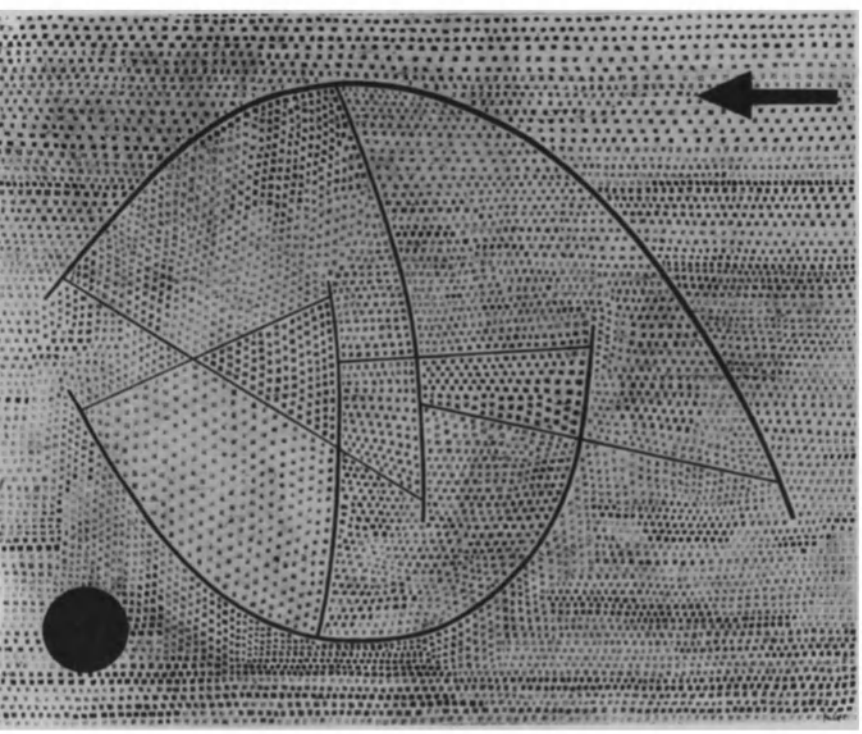
3

One of the outstanding figures of twentieth-century European art, the German painter Paul Klee (1879-1940) taught at the Bauhaus from 1921 to 1931. A gifted teacher as well as a great artist, he developed a theory of art rooted in his own work and founded on the principle that "movement is at the basis of all becoming". The idea of movement underlies his definition of line as the trajectory of a moving point and space as resulting from the movement of line. Klee's theory is illustrated here in a drawing significantly entitled *The Formation of Space by a Straight Line in Movement* (1). The free-ranging inventiveness with which Klee experimented with line is evident in *Fool in a Trance* (7) which the artist described as an "example of the superposition of movements captured on the spur of the moment". The figure is delineated with a single, unbroken line. The preoccupation with movement recurs in the watercolour *Choppy Rapids* (2), in which the mounting speed of the rushing torrent is expressed by the progressive subdivision into smaller units of a number of broad stripes. Klee sought constantly to refine and purify his theory of dynamics, and in the course on "the mechanics of form" which he gave at the Bauhaus in March 1924, he took the circle as the prototype of movement and the arrow as signifying directed movement. The watercolour *In Copula* (5) illustrates this development in Klee's thinking: a figure consisting of stretched segments oscillates in space between a red circle and a blue arrow. The arrow hurtles along horizontally; it escapes the clutches of gravity but does not climb as it gathers speed. The work symbolizes cosmic space in which movement is the norm and balance is the law. Klee believed that the deepest sources of the creative process reach into the unconscious. Hence his preoccupation (which made him one of the first artists to take an interest in drawings and paintings produced by children and the mentally ill) with the transfer of apparently irrational subconscious impulses into the world of consciousness. Something of this aspect of the artist's work can be felt in the pen drawing *Winged* (6). If the drawing is turned 90 degrees on to its right side, the two pointed shapes are seen to be energetically flapping wings. However, Klee specifically indicated that the figure (actually an angel) should be looked at horizontally.

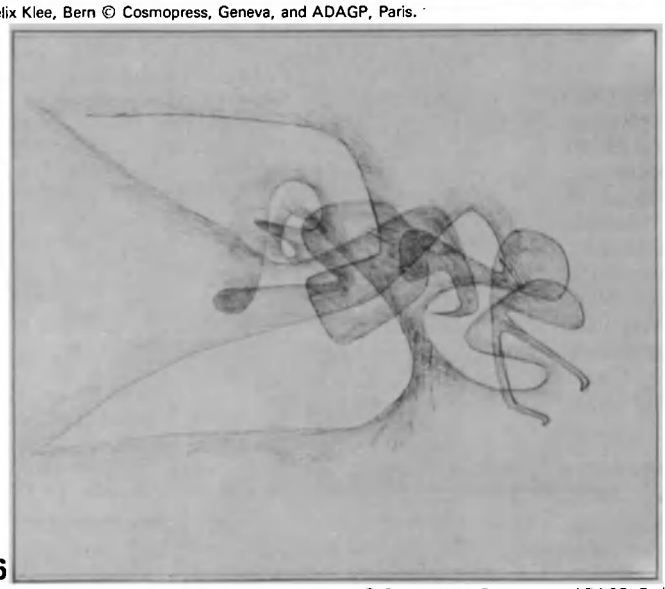
4

Photo © Alinari, Florence

Klee believed that painting should seek a reality beyond that of appearances, though without discarding elements of the visible world. Like all his works the watercolour *Olympus Destroyed* (3) illustrates this desire "to penetrate to the interior". A conglomeration of jagged saw-tooth peaks, haphazard flights of stairs, a door leading nowhere, pillars all askew, evoke the disaster which struck the abode of the gods. Although the treatment could hardly be more different, the theme recalls *The Fall of the Giants* (4) by Giulio Romano (the Italian Renaissance painter and architect, disciple of Raphael and Michelangelo and teacher of Rubens). Breaking with the representational tradition in European art, Klee coined the saying: "art does not reproduce the visible; it renders visible".



5 Photo Félix Klee, Bern © Cosmopress, Geneva, and ADAGP, Paris.



6 Photo Kupferstichkabinett, Kunstmuseum, Basel © Cosmopress, Geneva, and ADAGP, Paris

7 Photo Ludwig Museum, Cologne © Cosmopress, Geneva, and ADAGP, Paris

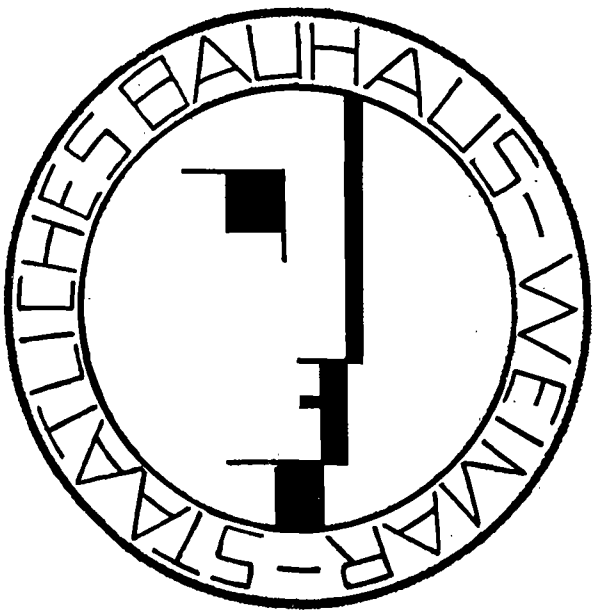


Photo © Bauhaus Archiv, West Berlin

Architects of an educational revolution

by Claude Schnaidt

"WHEN a young man who feels in himself the soul of a creator starts out by learning a craft, as he would have done in olden times, then he ceases to be an unproductive artist fated to practise his art imperfectly, for the craft, in which he can excel, gives him scope to cultivate his gifts. Architects, sculptors, painters, we must all return to the craft... Let us all together imagine and create the new edifice of the future, in which painting, sculpture and architecture will be one, and which will one day rise to the sky from the hands of millions of workmen, a crystalline image of a new faith".

This was the message set forth in the inaugural manifesto of the Bauhaus, the school of architecture and the applied arts which was created at Weimar in 1919 out of the fusion of the city's Academy of Fine Arts and School of Decorative Arts. The Bauhaus (the term literally means "house of building" and evokes the *Bauhütte* where medieval cathedral builders were lodged) moved to Dessau in 1925, then to Berlin in 1932, and closed down in 1933 when the Nazis came to power. The school's directors were in turn the architects Walter Gropius, Hannes Meyer and Ludwig Mies van der Rohe. Among the famous artists who taught there were Wassily Kandinsky, Paul Klee, Josef Albers, Laszlo Moholy Nagy, Johannes Itten, Lyonel Feininger, Oskar Schlemmer and Georg Muche.

CONTINUED PAGE 23

CLAUDE SCHNAIDT, *Swiss architect, is a professor at the* Ecole Nationale Supérieure des Arts Décoratifs, *Paris. He is the author of a monograph on Hannes Meyer (director of the Bauhaus 1928 to 1930) and of a number of works on technical, cultural and environmental problems.*

Colour page right

"There is no difference in nature between the artist and the craftsman: the artist is nothing if not an inspired craftsman", wrote Walter Gropius in the opening Manifesto of the Bauhaus in 1919. The unification of art and technically expert craftsmanship found expression in such fields as tapestry weaving, which had a prominent place in the school's curriculum. This brightly coloured tapestry was created in 1927-1928 by Gunta Stadler-Stölzl, then a teacher at the Bauhaus. Featuring several motifs associated with the work of great artists who taught at the school, it forms a kind of visual synthesis of some of the intellectual and artistic currents which met there. The motifs include the chequerboard patterns at left and right (Klee, Itten and Kandinsky) and the mountain and wave in upper section of tapestry (Klee).

Photo © Bauhaus Archiv, West Berlin

Centre pages

Five paintings by artists who taught at the Bauhaus evoke the brilliant and versatile creativity of which the school was the focus. Left hand page, below: *Ober Weimar,* an oil painting executed by the U.S. artist Lyonel Feininger in 1921. The upward-sweeping beam of light has been likened to a ray of hope in the sombre and chaotic world of Germany emerging from the post-war crisis. Above, *The Staircase at the Bauhaus* (1932) by the German painter Oskar Schlemmer. The German critic Ludwig Grote has seen the significance of the painting as symbolizing "all the Bauhaus meant for the young students who received its creative training. In harmony with the luminous architecture of Gropius, with its simplicity, its classicism, young people go up and down the staircase of the Dessau Bauhaus. They are inspired by its spirit and by the grandeur of the mission entrusted to them". Right hand page, below left: oil painting by the Hungarian painter and photographer Laszlo Moholy-Nagy, *Mein Buntes Bild* ("My Many-Coloured Picture"), 1933. Moholy-Nagy had a life-long interest in the effects of light and light in motion. He epitomized the Bauhaus's determination to create artefacts which could be easily reproduced (even from instructions given by telephone), standardized objects of "industrial art" for use in everyday life. In 1937 Moholy-Nagy became founder of the New Bauhaus in Chicago. Top, *Yellow-Red-Blue* (1925), oil painting by Wassily Kandinsky. It displays many of the characteristic motifs of his work which through his teaching became part of the school's collective heritage. Below right, *Eros* (1923), a watercolour by Paul Klee. The colour range is graded to follow dynamics of arrows and triangles.

Photo © Museum of Modern Art, New York. Gift of Philip Johnson

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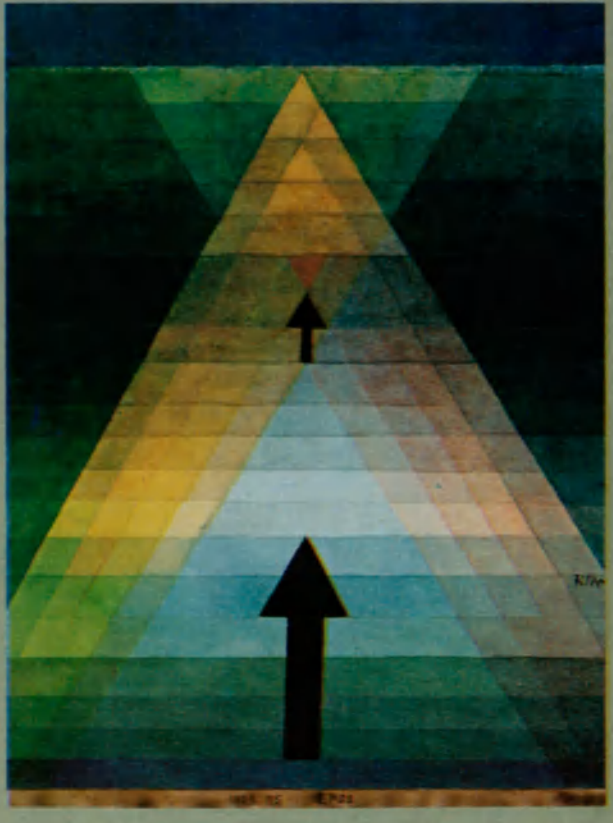

CONTINUED FROM PAGE 18

Colour page

The Black Prince **(1927), oil painting on canvas fixed to wood, by Paul Klee. The mysterious and powerful image is painted with the artist's usual economy of form.**

Photo Kunstsammlung Nordrhein-Westfalen
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Those who would epitomize this legendary institution as a community of exceptional personalities, a synthesis of arts and crafts, a shrine of functionalism, a home of the international style, or a leftist utopia of the turbulent twenties, do not entirely miss the point but they do not tell the whole story either. The originality of the Bauhaus stemmed from its refusal to be confined within the world of art and theory and from its insistence on making a mark on the material aspects of culture and on education. The Bauhaus went beyond the interpretation and comprehension of the modern world; drawing on all the most vital currents of its time and producing a wealth of innovations, it physically transformed the modern world, thereby strengthening its own influence. And yet, beset by the forces of conservatism, closed down three times in fourteen years, many of its ambitions were destined not to be fulfilled.

The school's existence might be broken down into three phases which in a way matched the three-act drama of the first German Republic: 1919-1924, a time of expressionism ending in the betrayal of revolution, in fear and inflation; 1925-1929, years of rationalistic hope for prosperity, triumphant technology and social-democratic management; 1930-1933, when perfectionism was paralyzed by crisis, unemployment and fascist terror.

In the early years, the students were taught jointly by two instructors, one a craftsman, the other an artist. Later when

Photo © Bauhaus-Archiv, West Berlin

Bauhaus professors photographed on the terrace of the students' house at Dessau in 1926. Left to right: Josef Albers, Hinnerk Scheper, Georg Muche, Laszlo Moholy-Nagy, Herbert Bayer, Joost Schmidt, Walter Gropius, Marcel Breuer, Wassily Kandinsky, Paul Klee, Lyonel Feininger, Gunta Stölzl, Oskar Schlemmer.

a new generation had emerged from this mode of training, the two branches were combined in a single teacher. The instruction was provided in two stages. First of all, during a preliminary course, each student performed a series of exercises which gave him an opportunity to learn how to handle materials, forms and colours. His creative energy was liberated and he developed his individuality through manual and artistic activities as well as through direct contact with nature. During the second stage, the pupil acquired through his experience of craftsmanlike production that sense of professional standards which would make him a responsible member of a team. The Bauhaus thus transformed the Romantic ideal of a return to craftsmanship into an educational instrument which could integrate the creator into the world of work and prepare him for a collective approach to industrial activity.

But if the teachers at the Bauhaus believed that manual work was a necessary part of the training of those who would do creative work in industry, they disagreed when it came to defining the nature of such work. For Gropius the school's existence depended on the development of marketable products in its studios and workshops. Kandinsky, on the other hand, regarded this approach as insidious. The motto coined by Gropius, "Art and Technology—A New Unity", aroused vigorous opposition within the school.

"Whichever way you look at it, it is crazy to call for the coupling of art with technology", Feininger objected. "A true technician will rightly shun any form of artistic interference, while the most consummate technical perfection can never replace the divine spark of art". To which Muche added: "Art and technology are not a new unity. They remain essentially different in their creative value... The formal artistic element is a foreign body in the industrial product".

Within the German economic system of the 1920s Gropius's "new unity" had no chance to develop beyond the experimental stage and become a social reality. Most of those associated with the Bauhaus were only dimly aware of this incompatibility. Lacking any clear idea of how to adapt their work to the existing system of productive relationships, they sought aesthetic solutions to the economic and social problems generated by the transformation they desired. They believed that an intensive search for a new formal vocabulary could somehow compensate for the absence of the historical conditions necessary for the fulfilment of their ideals. But this vocabulary would soon be appropriated by those whose clients belonged to an elite which loved anything and everything new, while the mass public for which the vocabulary had been intended had to make do with its degenerate and incomprehensible left-overs.

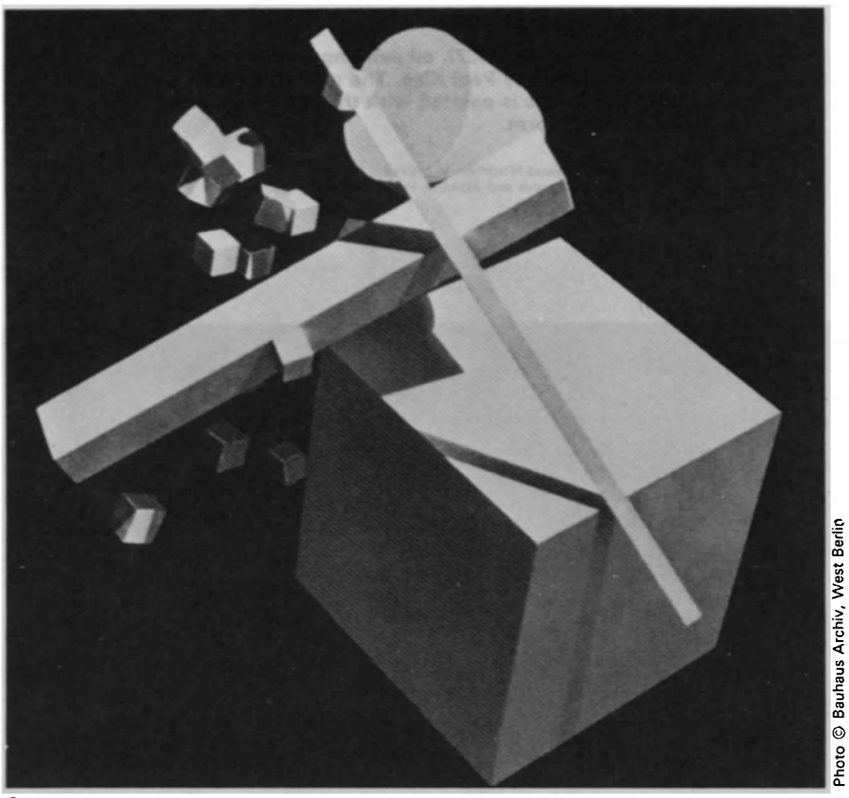
For Hannes Meyer, Gropius's successor as director of the Bauhaus, the quality of the man-made environment was something more than a problem posed by the relationship between art and technology. Meyer believed that if the creator wished to play an effective social role he should join forces with the workers' movement in its struggle to transform society. This meant leaving the ivory tower of aesthetic speculation, with its coterie of initiates, and creating standard products for the poorest members of the community. This new direction in the policy of the Bauhaus brought a greater emphasis on the exact sciences in the school's curriculum and the stepping up of productive work.

But by those for whom the Bauhaus was nothing if not a citadel of art, the new approach was seen as a betrayal. Meyer paid dearly for his ideas; two years and three months after being appointed he was dismissed. Nonetheless, during his term of office he developed a system of polytechnic education which reconciled thought and action and which attached a higher value to the creative zeal of students and teachers alike.

The incessant fertility of this short-lived institution was a product of the political and educational climate of the times. The Bauhaus expressed in microcosmic form the immense hope for a new life which inspired millions of people after the First World War. Without this hope, which arose from the collapse of the great European monarchies, from the birth of new nation-States, from great progress in the development of productive forces, the Bauhaus would certainly not have been what it became. The abundance, variety and boldness of the experiments carried out at the Bauhaus were largely due to the conviction that this was an age of limitless possibilities.

"Art and the people should form a single unity; art should no longer be the privilege of a minority but a source of happiness and life for the masses; our goal is to integrate the arts in great architecture." Thus, in 1919, proclaimed the *Arbeitsrat für Kunst* (Work Council for Art) of which Walter Gropius was a member. The work of the Bauhaus can be seen in this revolutionary perspective.

Ever since the beginning of the century traditional schooling had come under fire, and attempts to develop a new approach to education were being reflected in a host of experiments in many countries. The Swiss educationalist Adolphe Ferrière, the founder of the International Bureau of New Schools, was crusading for active methods. In Italy Maria Montessori had founded the famous *Case dei Bambini* ("Children's Houses"). In the United States, John Dewey and William Heard Kilpatrick proposed that the pupil should be placed in a context of authentic experience. The motto of the school founded by Ovide Decroly near Brussels was: "Few words, many facts". At Geneva, Edouard Claparède was working on the idea of functional education. Kerschensteiner in Germany put foward the concept of the "work school" in which the child was to measure his creations by his own experience; Lay and Meumann were developing experimental forms of teaching; Avenarius had



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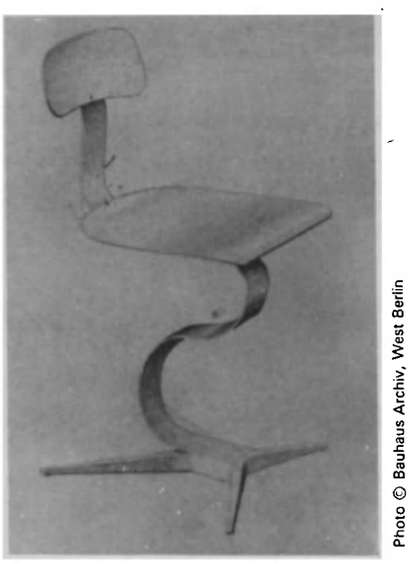
Art in everyday life



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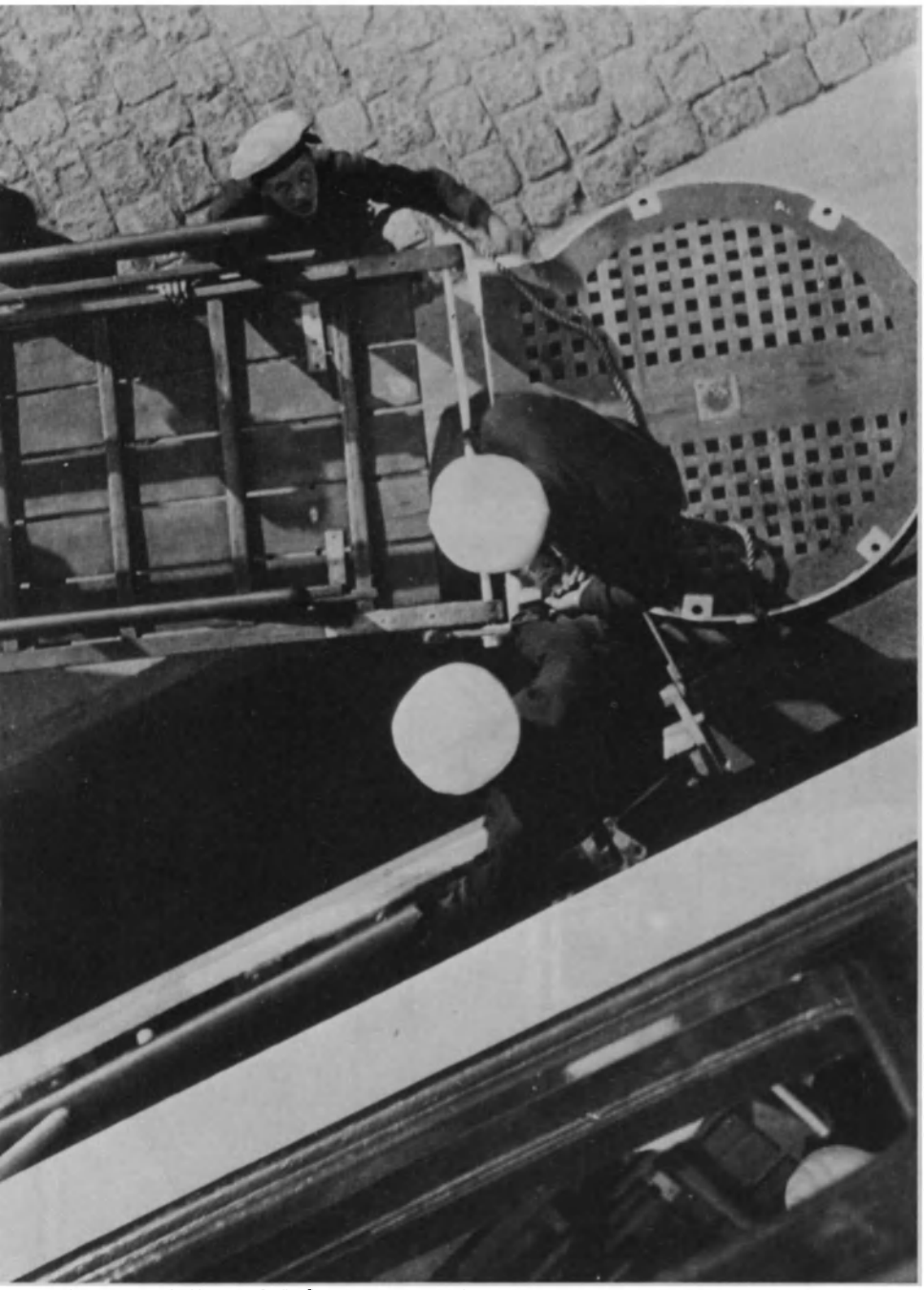

Photo Bauhaus Archiv, West Berlin © Klihm Gallery, Munich

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Photo © Bauhaus Archiv, West Berlin

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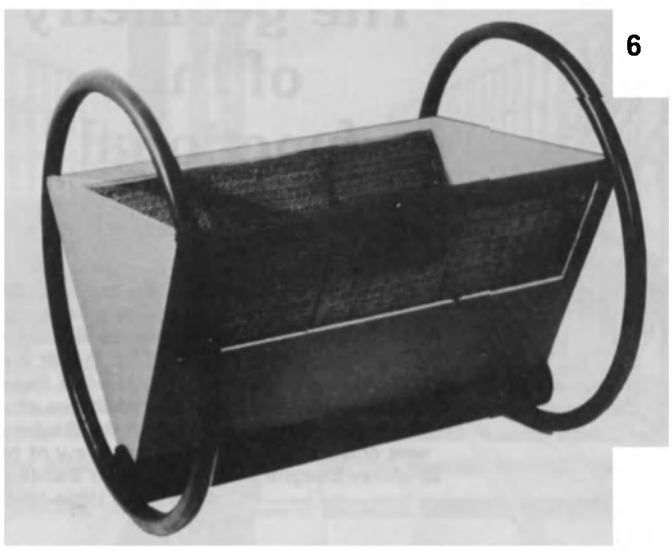
"The school must serve the workshop; one day it will find fulfilment there" said the Bauhaus programme of 1919. Rejecting the academicism of the traditional art schools, the rigorous Bauhaus courses combined theory with practical training in workshops of carpentry, stained glass, painting, metalwork, weaving, pottery, stagecraft, wall painting, photography, architecture, typography and book-binding. The goal of this training was to prepare pupils to create functional artefacts which could be mass-produced in industry yet would still possess aesthetic qualities. After a spell of factory work, the best apprentices developed prototype designs for products used in everyday life; many of these products were later adopted for large-scale manufacture and marketed. Ultimately, it was hoped, a new generation would emerge to infuse reason and humanity into the impersonal world of industry and create a new art of living appropriate for the twentieth century. A belief in unity, creativity, simplicity, the functional conception of the object—these and other principles kept the Bauhaus from being side-tracked into "style for style's sake" and brought it a far-reaching influence in industrial design.



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1 *Dispersed Order (Disorder),* plastic study by Joost Schmidt
2 *Footbridge* (1926), photograph by Laszlo Moholy-Nagy
3 Poster by Joost Schmidt for the Bauhaus Exhibition, Weimar, 1923
4 Spring-chair by Alfred Arndt
5 Lamp (1923-1924) by Wilhelm Wagenfeld and K.J. Jucker
6 Cradle (1922) by Peter Keler
7 Teapot and sieve (1924) by Marianne Brandt

Photo © PGH Die Camera, Dessau, German Democratic Republic

The intellectual climate of the Bauhaus was influenced by the abstract geometric forms characteristic of the constructivist movement in art. Below, *Project for Sculpture of Angle* (around 1915) by constructivist leader Vladimir Tatlin, considered the greatest Russian architect of the time. Right, constructivist principles of geometric logic applied by the Dutch painter Piet Mondrian in *Composition in Blue-A* (1917).

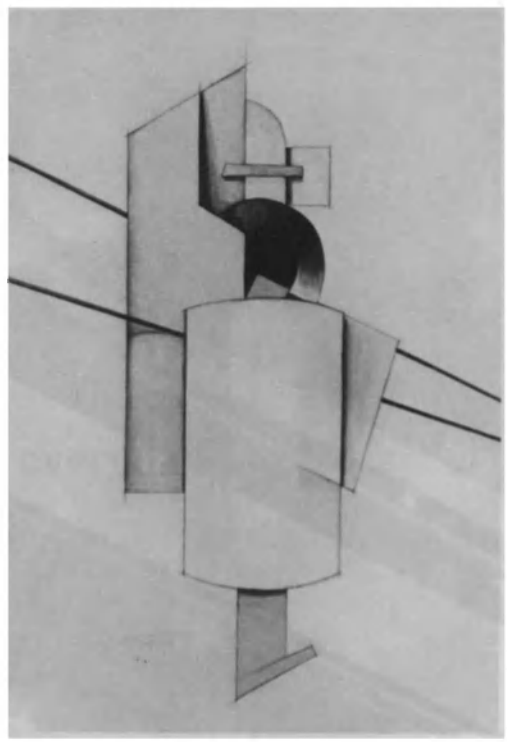
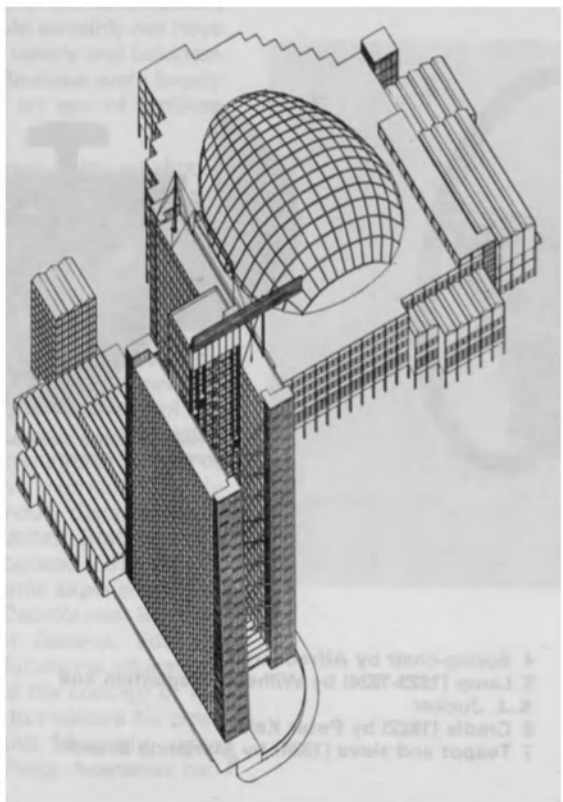


Photo Galerie Chauvelin © Museum of Modern Art, New York

Above, entrance to a wing of the Bauhaus building at Dessau, designed by Walter Gropius and completed in 1926 (photo was taken after extensive repairs in 1976). All the Bauhaus workshops contributed to the new building, a classic of 20th century architecture. Its cubist rigour of volume, the absence of ornamentation and almost exclusive use of glass for the façade are typical of the new architecture of the 1920s and 1930s. With the move from Weimar to Dessau came an intensification of architectural work at the Bauhaus.



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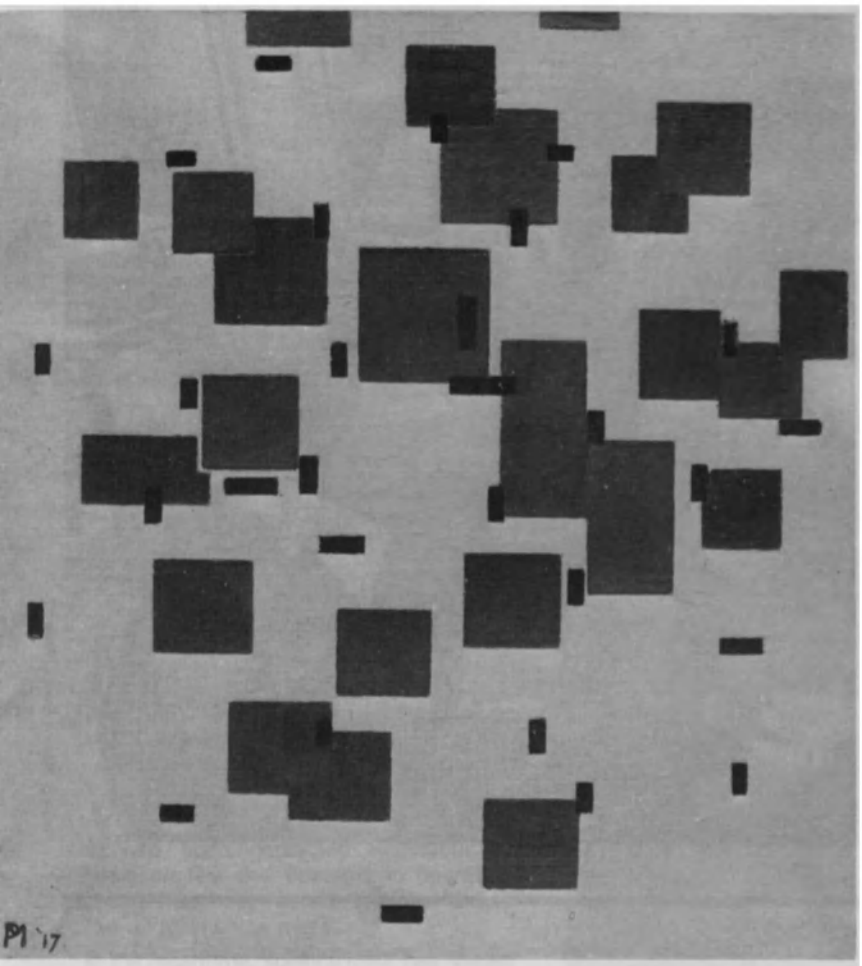
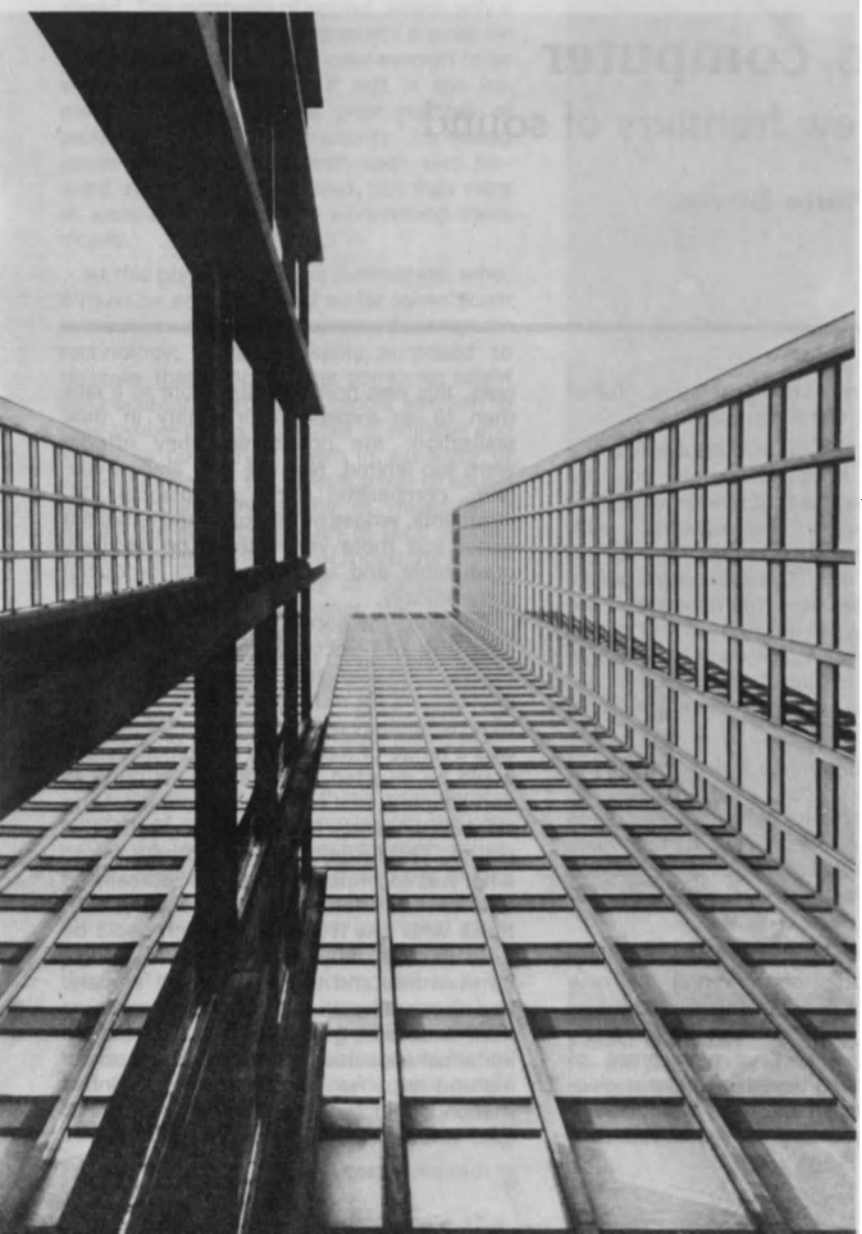
The geometry of the functional

Hannes Meyer, who suceeded Walter Gropius as director of the Bauhaus in 1928, saw architecture as above all a collective activity. Left, Meyer's project for the Palais des Nations, Geneva (1926-1927). Meyer was followed as director by Mies Van Der Rohe, who emigrated to the United States after the Nazis came to power and the Bauhaus was closed. Right, worm's eye view of his 39-storey Seagram Administration Building, New York (1954-1958).





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launched the artistic education movement; Otto, Gaudig and Wyneken practised in their respective schools global methods, personality education, and community training. All these educators were trying to answer the following questions: What role should the school play in the development of society? How could the school be brought closer to life? What connexion should there be between education and work? How could pupils be encouraged to become more active and spontaneous? What could be done to prevent teaching methods from becoming formal and rigid?

The revolutionary events of 1917 and 1918 gave a new impulsion to this movement. The U.S.S.R. adopted the Marxist principle of polytechnic education based on the necessary link between education and productive work. Lunacharski, Krupskaya and Blonski directed the implementation of this programme, while Makarenko founded the famous children's communes. Under the new German constitution the "work schools" became compulsory. A large number of experimental schools were organized as *Lebensgemeinschaften* ("life-communities") which aimed to establish close co-operation between teachers, pupils and parents. The anarchistic "free schools" movement, inspired by the methods of expressionistic art, began to spread from Hamburg and Bremen. In these schools without any set curriculum everything the children learned was to be drawn from their own experience. Different though the various systems were, the intention behind all of them was to give the child the active role in his education in a school with an open outlook on the world. The Bauhaus was an episode in this great movement; its distinction lay in introducing the new approach into higher education.

The very structure and size of the Bauhaus contributed to its vitality. Even at its biggest in 1929 it had no more than 197 students, a dozen full-time and five temporary teachers, and one or two lecturers. The roster of all the enrolments totals only 1,250 names. And yet, small though it was, this school on the fringe of the public education system had a relatively generous budget and was not handicapped by the traditions and privileges which take root in old institutions. Information circulated freely. There was a minimum of bureaucracy, and responsibilities were decentralized to a large degree. At the highest level, the load of teaching and administration was shared. The size of the decision-making bodies meant that they could act quickly. The school's output was also stimulated by the close contacts between some of the students and the teachers (some of whom lived on the premises), as well as by the atmosphere of militant internationalism.

Furthermore, the Bauhaus broadcast its own message, in the full understanding that a school must give in order to receive. Through books, through its magazine, through exhibitions and other events, it sparked off exchanges and debates which won its work a wider audience and at the same time benefitted the school. It was this outward-looking spirit which led those associated with the Bauhaus to record, sometimes naively but always effectively, the theories which underlay their activities, and to present their works in such a way that they were accessible to the largest possible number.

And yet, looking back at the Bauhaus, one cannot fail to be struck by the contrast between the profusion of its discoveries and the paucity of their consequences, between the confidence of its assertions and the precarious fate which lay in store for them. During its lifetime, the Bauhaus was a constant target of calumny, intrigue and attacks from the hidebound. When it was dead, the Nazis did all they could to obliterate its memory. Most of the countries where its former teachers and pupils settled did what they could to render them inoffensive. In the undying controversy which surrounds the legacy of the Bauhaus it is possible to discern an attempt to discourage and to alienate those who are struggling for a better world and to destroy the idea of progress which still, in spite of everything, has a future.

■ **Claude Schnaidt**

Photo © Martine Franck, Paris

Maestro computer

Exploring the new frontiers of sound

by Pierre Boulez

IT often comes as a surprise, and generally not an agreeable one, to hear the words "music" and "computer" pronounced in the same breath. Indeed, few words evoke such widely different, if not frankly antagonistic notions as the former, with its connotations of free-ranging imaginative power, and the latter, which suggests scientific rigour at its most strict.

Upon closer examination, however, the stereotyped nature of this reaction becomes apparent. Imagination is, of course, essential to music; but composition, performance, improvization and interpretation alike presuppose a degree of familiarity with many different codes which only a long and sometimes painfully rigorous apprenticeship makes possible; without constraint, discipline and knowledge, imagination is liable to degenerate into mere fancy, "full of sound and fury, signifying nothing".

As far as the computer is concerned, the argument that both the nature and the mechanics of such a tool render its use for musical purposes incompatible with freedom of invention is, to say the least, a very simplistic one. Consequently, before we address ourselves to the question of the relationship between informatics and music, we must firmly reject the dichotomy which sets the candle-lit garrets of genius in opposition to the complex institutions of technocracy.

What, then, are we to make of the state of affairs brought about by a technical advance so rapid that its consequences could hardly have been foreseen some thirty years ago, when the possible impact of electronics on music provoked the first stirrings of interest?

To begin with, we should make a distinction between attempts to enrol the new technology in the service of musical creation and invention, and the much earlier trend towards the invention of new types of musical instrument based on certain electronic techniques. If many of the resulting instruments enjoyed only short-lived success, this was probably due more to a lack than to an excess of originality in their realization; the possibilities they offered were too limited. Nor did they always sustain comparison with traditional instruments, whose output of sound remained richer and more varied than the relatively predictable and uniform results produced electronically.

But once the concept, albeit a somewhat hazy one, of "electronic music" was admitted, no time was lost in seeking to clarify its implications for musical research. What the new technology proposed first and foremost was a range of measuring equipment which could be diverted from its original purpose and adapted, in a more or less artisanal and *ad hoc* fashion, for the reproduction of sound. The irruption of the computer into what was essentially an aesthetic domain led to a number of stormy discussions between those who saw it as a tool which could be used to strip the phenomenon of sound to its essentials and then re-invent it entirely; and those who thought that the machine itself should be given free rein, and that its immense capacities for absorbing, processing and re-transmitting all manner of information could be used for the creation of spontaneous poetic "happenings".

PIERRE BOULEZ, *French composer and conductor, is director of the Paris music research centre IRCAM* (Institut de Recherche et de Coordination Acoustique-Musique) *and professor of music at the* Collège de France. *Among his more recent compositions are* Rituel *(1974) and* Messagesquisse *(1976). This article is based on a paper prepared for an international symposium on "Informatics and Society", held in Paris in September 1979.*

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In practice, however, neither of these paths proved straightforward. The first came to a virtual dead end when the tool was found to be far from adequate for the satisfactory synthesis of sound. The second, in which serious and thoughtful planning had been neglected in favour of reliance on flair and dexterity in operating the machine, became lost in a sterile and above all wearisome maze.

In the meantime, science itself had forged ahead. The synthesis of sound, which only a short time earlier had appeared to pose insurmountable difficulties, now seemed to be an attainable objective, if not in the immediate future. True, a great number of problems, whose complexity increased rather than decreased with each step forward, remained to be solved, but they were at least beginning to be understood more clearly.

At this point, musicians themselves, who, it must be admitted, had so far taken scant interest in the development of computer technology, were agreeably surprised to discover that although the computer might not necessarily propose a global solution to their problems, its capacities of analysis and synthesis could help them in a variety of ways: not only in the investigation of sound itself and the philosophy of music as a whole, but also in the study of such specific subjects as the language of music, its formal structures and the rules of composition. They discovered, too, that the machine could help with practical, as well as theoretical tasks and that it was capable not only of writing scores for performance by traditional instruments, but also of reproducing the sounds written into a traditionally prepared score.

It is worth noting here that a considerable number of performing musicians are now taking an interest in the relationship between computers and music (and not merely with the aim of arming themselves against future developments). They set great store by the principle of real-time working since they feel that use of the computer to bring an element of instant transformation of sound into a performance helps to preserve the factor of uncertainty without which they find true communication with their public impossible. A piece of music, like a work written for the theatre, constitutes an "ab-

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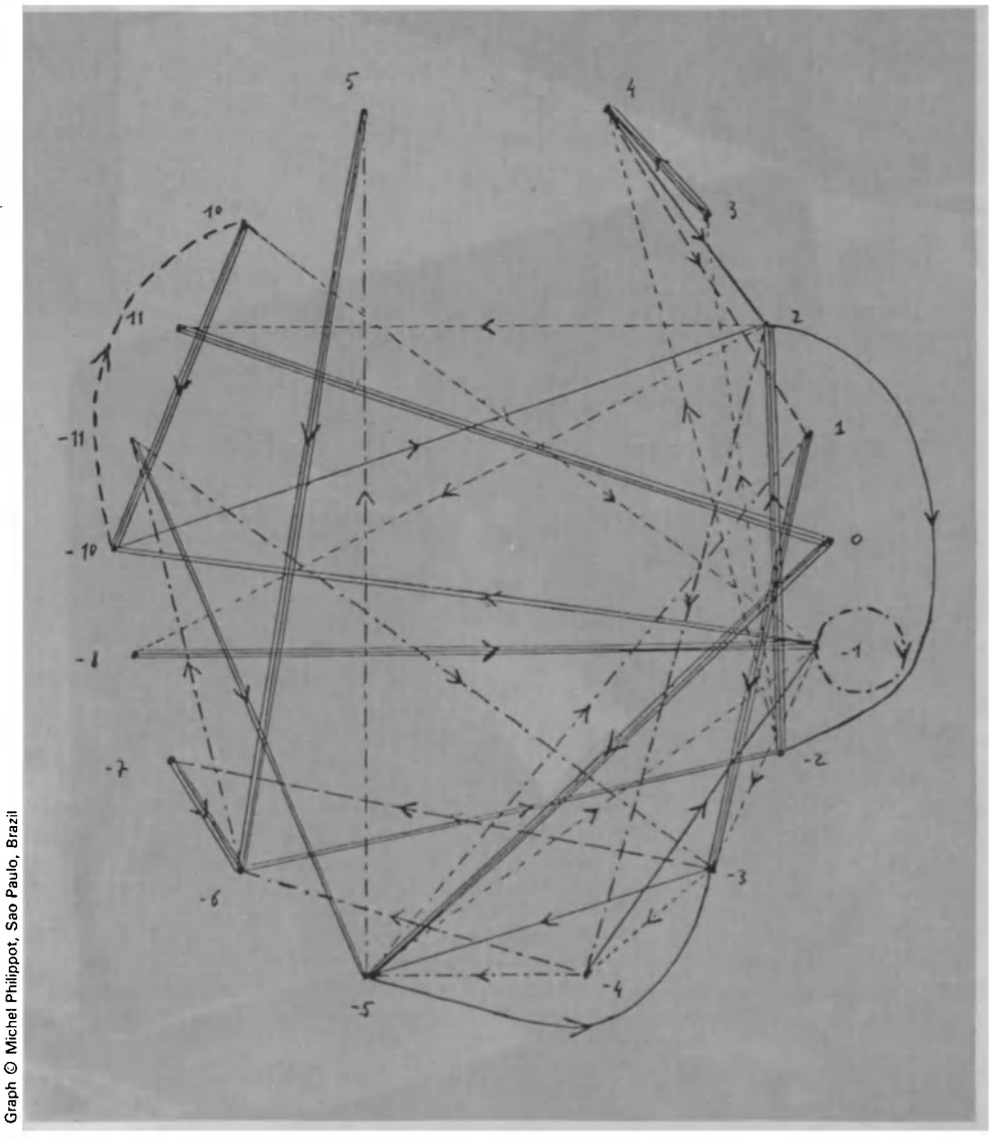
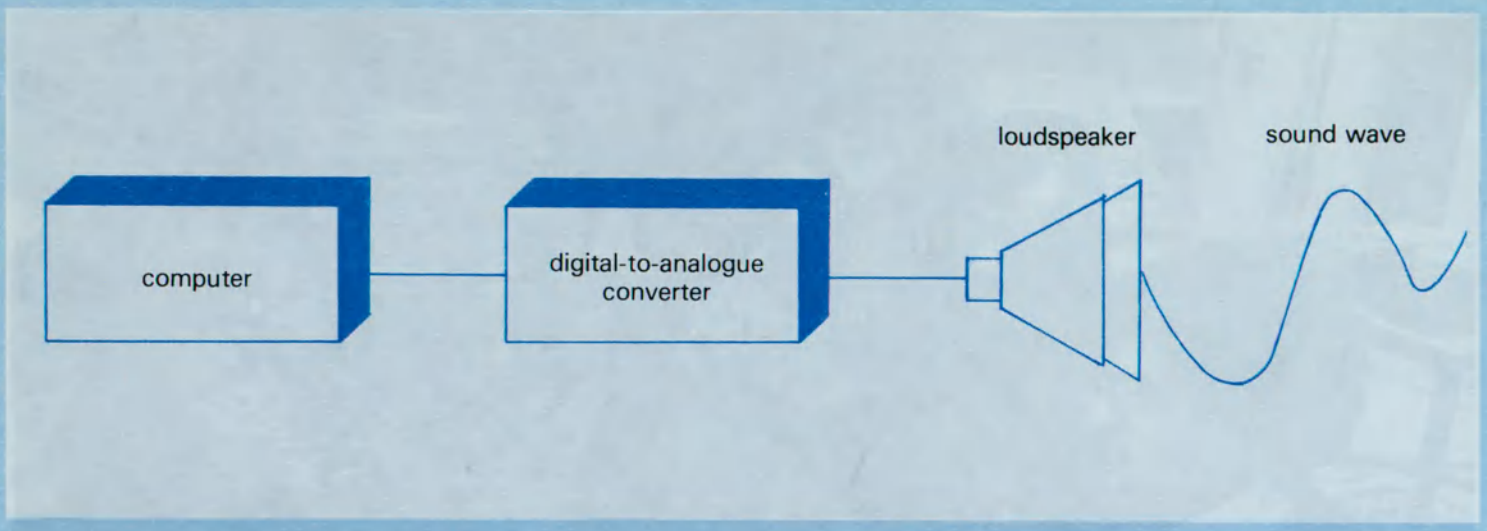


Graph © Michel Philippot, Sao Paulo, Brazil

Photo opposite page, researchers operate a digital synthesizer, an apparatus for creating electronic music which, when coupled to a computer, can provide taped recordings of an almost limitless range of pitch, timbre and volume. Small synthesizers can also be used for the production of "live" electronic music. Above, thematic graph for an orchestral composition. Based on an initial analysis by a computer, it guides the composer as to the options open to him in the development of a composition for orchestra. Top photo, the "Song of Songs", a Flemish engraving of the 17th century.



Graphic Unesco Courier

Photo J.P. Armand © IRCAM, Paris

Music by numbers

By making available to the composer a new gamut of sounds, ranging from random noise to pure tones, and by allowing him, if he wishes, to dispense with instrumentalists and address his audience directly, the computer has revolutionized musical composition. In addition, the computer has opened up new fields of acoustical, theoretical and musicological research and analysis and can be used to process musical notation and to print music. Top right, a three-dimensional computer-generated display of two seconds of playing time of a melody played on an oboe. The composer can feed information into the computer in the form of numbers or by writing with a light-pen on an input screen, left. Top left, the computer processes this information which is then passed through a digital-to-analogue converter, an apparatus that transforms data from the computer into electrical impulses that cause a loudspeaker to vibrate and produce sound. Right, computer-produced graphs of half a second of sound synthetized by a computer to simulate the sound of a trumpet and the same sound analysed and broken down by the computer into six of the most important harmonics of which the sound is constituted.

Photo © North Holland Publishing Co. From *Computers and the Humanities*, July-Sept. 1979

Graphs © Marc Battier, IRCAM

CONTINUED FROM PAGE 29

solute" which, by last-minute adjustments at the moment of interpretation, becomes "relative"; what creates the musical or dramatic event is the passage of the performers along this tightrope between certainty on the one hand and uncertainty on the other. Any future application of computer technology to music will have to take account of this need for uncertainty, and of the question whether machine-made music should be a finished product or, on the contrary, merely a framework to be filled in at the moment of performance.

In order to understand what is involved more clearly, let us look at some of the ways in which electronic techniques are, or might be applied in the field of music, beginning with the reproduction of sound. In a conventional sound reproduction system, vibrations picked up by a microphone are transformed, or "transduced" into an electric current, and then converted back into vibrations by means of a loudspeaker. But while they are in the form of an electric current, the sounds can be subjected to various kinds of treatment; they can, for example, be amplified or recorded.

Suppose now that we connect to the output of the microphone a device which measures the current induced by various sounds and which converts these measurements into another scale of values—into a set of numbers, for example. If we feed these numbers into a second device, which is capable of carrying out the operation in reverse, we shall obtain a fresh current; this in turn can be converted into vibrations, and hence sound, by a loudspeaker.

But will the current leaving the microphone be identical with that entering the loudspeaker? Not exactly, because during the process of measuring the former and transforming it into a numbered code, the first device (called by computer scientists an "analogue-to-digital converter") will have "dropped" the fragments of current which passed during the intervals between measurements, thus failing to encode those fragments for the second device (the "digital-to-analogue converter"). In other words, the output from the microphone is continuous, while the input into the loudspeaker is discontinuous. In practical terms, however, that is to say as far as the perception of sounds by the human ear is concerned, and provided that the current is measured at sufficiently close intervals, the listener will be unable to distinguish between what goes into the microphone and what emerges from the loudspeaker.

Suppose now that we eliminate the direct source of sound, dispense with the microphone, and replace the analogue-to-digital converter by a computer, which we instruct to produce a set of numbers based on the same sort of values as those measured earlier, the information provided by the computer will result in synthetic sound—in other words in sound whose origins lie nowhere in the natural world, and which the natural world may well be incapable of producing.

Let us take a specific example to make this notion of the synthesis of sound more clear. Percussive sounds, such as those obtained by striking the surface of a wooden or hide-covered instrument, are very rich and complex, but they are of short duration and not self-sustained. They may be considered as being similar to "noise" and it may be difficult to fit them into any logical arrangement or pattern because they often depend on chance and on the varied nature of the materials with which they are made. With the use of electronic devices, their distinctive quality, or timbre, can be produced artificially and at precisely the required moment, for the length of time required and with the desired gradations of loudness or softness; what is more, whole families of sounds of the same tone-colour, linked by a scale or an imposed system of values, can be synthesized in this way.

Thus, solutions can be found to problems which nature itself pronounced intractable, the potential of existing sound-making materials can be extended, and all the conditions are realized for a leap into the unknown; although the latter exercise requires at least as much enthusiasm as scepticism, because we are still too attached to "nature" (whether in the domesticated form beloved of European and other civilizations, or in its untamed state) to be able to imagine or perceive without difficulty what is, quite literally, "unheard of". It is certainly true, nevertheless, that as far as the synthesis of sound is concerned, the only limits are those imposed by the imagination of the "technician-performer" who operates the equipment.

In this new context, the musician can no longer content himself with knowledge based on the heritage of sound transmitted by his own or other civilizations; he can no longer rely on the amalgam of musical and aesthetic notions which has, up to now and notwithstanding certain developments in language and signification, prescribed *a priori* which sounds are "permissible" in accordance with historically-determined criteria. Moving like an astronaut into the outer space of aesthetics, exploring and familiarizing himself with the unknown, the modern musician must—in order to carry out certain specific tasks—have the grounding in mathematics and physics which will enable him to determine the relationship between "physical" and "musical" sound.

This requirement is not as extravagant as it may appear. For example, when a composer learns to compose and arrange music for a particular instrument, he is not expected to be able to play the instrument in question with outstanding virtuosity; nor is he expected to be able to construct it, or to analyse scientifically its acoustic potential. He *is* expected, on the other hand, to know the tones the instrument is capable of producing in a particular register, according to the manner in which it is played, and the practical applications as well as the limitations imposed by its construction. He is also expected to understand, through extensive background reading, its aesthetic significance within the overall context of musical expression.

In the field of electronic, or "machine-made" music, the need to determine the relationship between physical and musical sound, and to integrate this relationship in the creative process, entails the development of new skills. Rare are the composers who are sufficiently versed in the new techniques to apply them unhesitatingly, or who have developed an adequate intuitive feeling for the unknown. What is required, in fact, is a judicious blend of knowledge and intuition, making it possible to look ahead, and to extrapolate on the basis of established data. But these same data, derived from the familiar, instrumental world, can themselves serve as raw material which, analysed and then transformed, can be used to produce results so far removed from the initial source that the latter is wellnigh unidentifiable.

Analogue-to-digital conversion which, as we saw above, involves the transformation of some physical quantity (in this case, sound) into a numerical coding, in fact provides data which the computer can process in two different directions. In the first place, relatively simple operations such as filtering, the inclusion of echo effects, or various types of modulation can alter the initial sound, and lead to substantial transformation of the original tone-colour. Although the results obtained are sometimes very interesting, they are not easily controllable, and their use soon leads to tiresome monotony. Instead of being highly individualized, particular and selective, the timbre imparted by the instrument loses its character and emerges after processing as anonymous and banal.

It may prove more interesting and worthwhile, therefore, to explore the second possibility offered by the computer—that of analysing and extracting from the data the parameters which constitute a given sound or timbre. A whole series of techniques is available in this connexion, the most important of which at the present time involves identification, at a given moment, of the exact note produced by the instrument concerned. Once this "fundamental sound" has been extracted, a process of synthesis can be initiated, following with a very high degree of precision the sequence of intervals—monodic, naturally—produced by the instrument.

However, a certain number of scientific and technical difficulties remain to be overcome. The richer the sound produced by the instrument, the harder it is for the detecting device (on which the analogue-to-digital conversion depends) to cope with the different characteristics, some of them of an extremely fleeting nature, of the sound received. The risk of inaccuracy is consequently increased, especially if it is intended to extract these characteristics in a real-time operation; when this is the case, what would normally be considered as a perfectly acceptable margin of error becomes quite inadmissible and the whole system is called in question as a result.

The notion of real-time operation is one to which musicians are firmly attached, since it allows for the inclusion, in the act of interpretation, of an element of chance, or rather of opportunity in the most positive sense of the term. This being so, it would appear logical, if not indispensable, to consider the computer, in its musical role, as an instrument just like all the other instruments which depend on different techniques.

It should be noted, however, that between the emission of two sound signals the computer must carry out about 100 operations (additions, multiplications and other calculations); but the time interval between two signals is about 30 millionths of a second. This means that, in real-time working, no more than 300 thousand millionths of a second are available for each of these calculations.

No computer at present on the market is capable of working at this speed, and it is

thus necessary to separate the operation into two parts. In the first stage, the computer makes the required calculations at its own speed, and commits the resultant data to memory. In the second stage, it transforms these data into sound signals, transmits them at the required speed, and records them on a conventional magnetic tape. When the time comes for the concert, the tape is available and all that is then required is a tape recorder on which to play it.

The undoubted advantage of such a procedure is that it involves relatively inexpensive equipment, which can be transported without difficulty to the concert hall. On the other hand, pre-recorded music is definitive; it excludes all possibility of different interpretations and leaves no room for "chance" during performance.

It should be possible, however, in the not too distant future, to introduce microprocessors into the system, by means of which pre-recorded music can, to some small extent, be modulated during performance. Furthermore, it is possible to construct specialized machines which, linked to an appropriate computer, can modify the functioning of the latter to the extent that real-time processing and the synthesis of sound become attainable objectives. In this case, the computer becomes a musical instrument in its own right, and can be "played" by means of appropriate attachments such as keyboards, potentiometers or contacts. Since they can be used both to produce sounds of their own making, and to modify the sounds produced by other instruments, these specialized assemblages allow for individual "interpretations"; the operator can combine these two modes at the moment of performance.

Like the composer of electronic music, the "technician-performer" must now cope with new problems; he must have the basic knowledge which enables him to understand the instantaneous phenomena provoked by manipulation of the machine, and this poses the question of his training. The rules for "playing" a computer differ from those which govern the use of traditional instruments, since the former picks up signals other than those sensed by the human ear or, at least, reacts to them differently. For example, variations in the attack of a sound which pass unnoticed by the ear, can be detected by the machine, as can fine nuances of range or pitch. On the other hand, the ear can notice aesthetic subtleties which leave the computer unmoved.

The computer can do more than create or transform sounds. It can also schematize and analyse the mechanics of musical language, and convert music itself into visual displays. This is probably the field of application in which least has been achieved so far, and the results of research, conducted in perhaps too rudimentary or too academic a fashion, are somewhat disappointing. Following the example of the linguists, who have used the computer for highly specific purposes, certain musicians have indeed attempted to analyse the classical techniques of counterpoint and harmony, but the results achieved are in no way comparable with those obtainable by any competent student of music who applies his imagination and aesthetic sense to good effect.

Why, in a contrapuntal composition, and despite the fact that it obeys exactly the same laws and interdictions, is one melodic

CONTINUED PAGE 38

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SEX STEREOTYPES IN THE CLASSROOM

by Fay E. Saunders

IN most countries, parents, educators and the public at large would protest at the suggestion that discrimination and inequalities exist between the sexes in respect of educational opportunities. It is still, in fact, too often held that there have always been and always will be particular and specific roles for men and women in the organization of any society. They might add that education should prepare young people for these roles.

A closer look at what actually occurs in the upbringing and education of children in the majority of countries reveals that organizational barriers have in fact been removed in many places in recent times at various levels of the formal educational process but that this is not true of the attitudinal barriers. Certain attitudes die hard among most of those on whom rests responsibility for preparing the young to contribute to society while providing them with the best and widest opportunities for personal development and realization of individual potential.

Although much progress has been made in many countries, the achievements have not perhaps been as marked as they could have been because of the great influence exercised in the child's education by the home and community. It is in the home that the inculcation of ideas about sex roles is so effective and therefore, even before children arrive at school, they have a clear appreciation of the role they will play in the scheme of things.

This subtle but very lasting influence continues after they enter school and plays an ongoing role in their development.

And from their earliest experiences at school, the role learnt so well at home is continually reinforced, often unconsciously perhaps, by much of what takes place at school.

Perhaps the most marked examples of discriminatory practices and unequal opportunities are to be found in some developing

FAY E. SAUNDERS, *Jamaican educator, has been Parliamentary Secretary to her country's Ministry of Education, President of the Jamaica Teachers' Association, and Vice-President of the World Confederation of Organizations of the Teaching Profession.*

countries where few provisions for education for girls exist at any level at all. In 1976, it was estimated on the basis of United Nations population statistics that 79 per cent of the 712 million girls in the world under 15 years of age were to be found in the developing countries. Of these, the majority live in rural areas where the problem of eking out an existence forces most families to retain girls in the home to perform the household chores and this occupies the greater portion of their time.

In addition, time for education is not considered necessary since women are traditionally seen as "producers of food as well as life-givers". As a result, very few girls have access to education or skill-training. Indeed, a United Nations report states that agricultural training for girls as compared with boys was in the ratio 14:86 although women make up one-third to one-half of the world's agricultural labour force.

Even in countries where educational opportunities do not present a problem, the old idea of giving education to the boy rather than the girl, if it comes to a choice, dies hard. This is the case in some countries of Africa where the burden of maintaining the family, particularly in rural areas, continues to rest very heavily on the women and girls. Indeed, in spite of tremendous progress made in providing education —even compulsory education— in places such as Nigeria and Kenya, the percentage of children admitted into primary schools continues to be low and the higher the grade the lower the proportion of girls.

Enrolment patterns for the 6 to 11-year-old group show that in 1975 in many developing countries (22 in Africa, 2 in Latin America, 7 in Asia) fewer than half of the children were enrolled in school. The picture as regards enrolment of girls was even more dismal, with 41 developing countries enrolling fewer than half the girls in this age group. In fact, in 1975, there were 30 million more boys than girls aged 6 to 11 enrolled in school.

Within recent years, more and more anxiety has been expressed, especially by teachers and women, that the formal process of education should be reorganized in such a way as to provide experiences at all levels for boys and girls, based on genuine choice in which the only criteria are interest, ability and the will to succeed. No society can any longer justify, on the basis of traditional sex roles alone, the failure to provide opportunities for the full development of all its members.

It is worth noting that changes are taking place, in real terms, in a wide variety of ways and at different rates, depending partly on the milieux and partly on the disposition of parents, pupils, teachers and society at large to acknowledge that inequalities do exist and that it will be to the benefit of all concerned if changes, properly identified, are in fact implemented.

Some of the most far-reaching changes are taking place in the developing world. This may be attributable, in part, to the desire of such countries to divest themselves of as many practices as possible which are considered to be related to their former colonial status. In addition, it is obvious that their extensive development plans are geared to the full training and use of all their human resources. For example, in Singapore, teachers report that:

> Girls... are not excluded from technical and science subjects. In fact, their attendance and performance in technical workshops on basic electricity, metalwork and woodwork are compulsory in the lower secondary classes. The girls are never automatically channelled into courses with domestic science subjects. In certain schools, boys are encouraged to become members of a special home economics society for boys.

At the tertiary level also, young women frequently choose courses in practical electronics (e.g. television and radio repairs) to the extent that it is not unusual for the proportion of women in such courses to exceed that of men. On the other hand, in Sweden, a country long recognized as being in the vanguard of positive action for sexual equality "not all parents are happy about their boys baking cakes."

A major factor in the perpetuation of discriminatory practices in several places is the fact that some of those most influential in effecting changes are unaware of how deeply engrained are their own ideas of the traditional sex roles and expectations. Hence, while they openly deplore such practices, they themselves unconsciously continue to inculcate the very things they claim to abhor.

One teacher-leader from a developing country, who is very sensitive to the "remnants of male chauvinism" in her culture, insists that "discrimination between sexes with respect to the objectives and contents of education is no longer found, except that the curriculum... includes such special subjects *as are suited to women only,* that is sewing, cooking, etc."

Similarly, while many teachers in different countries have been making vigorous attempts to remove needlework as a compulsory subject for girls at certain levels, there are others who resolutely resist these attempts.

It is probably in the area of the school curriculum, particularly at secondary level, that the unequal opportunities offered to, and provided for, boys and girls become most evident and most widespread. The disadvantages arising from this perhaps most affect girls. It is not sufficient to aspire to a particular career or occupation if the necessary academic foundation is lacking.

The consequent frustrations and disillusionment (especially when it is noted that others have the necessary opportunities) often result in a retreat to the traditional role. Further, while we are not suggesting that equal opportunities should be synonymous with identical opportunities, the common practice of deliberately planning curricula solely on the basis of sex is a direct violation of the concept of the right of the individual to education. For unless education is so designed as to fulfil the needs and aspirations of the individual as well as to provide the base for effective living in a society, the whole education exercise can be little more than a sham.

Freedom of choice should be the only factor in determining educational programmes once the individual has the ability and the basic tools of learning, is knowledgeable about the choice he or she is required to make and is motivated in a particular direction. Thus pupils who wish to follow the traditional feminine or masculine orientation should be free to do so just as they are free to take different or even unorthodox directions without being made to feel guilty or inadequate.

In the majority of societies, the traditional role determined for a boy from the earliest stages is that of family breadwinner. The education provided is, therefore, geared to prepare him for this role. Schools guide him in this direction and he is encouraged to pursue certain subjects which will provide the foundation for higher and further education. He soon discovers the specific qualifications for which he must aim.

This is particularly the case at the secondary stage when he is expected to study certain "boys' " subjects such as mathematics and the sciences. In a survey carried out by the Department of Education and Science in England and Wales it was recorded that at the fourth- and fifth-form levels of secondary schools, 90 per cent of the boys and 71 per cent of girls were offered physics as an option. Of these, 47 per cent of the boys and 12 per cent of the girls actually studied the subject. Similarly, 70 per cent of the boys and 76 per cent of the girls were offered the choice of chemistry with 27 per cent of the boys and 17 per cent of the girls accepting the offer.

On the other hand tradition dictates that girls should pursue subjects of a more "feminine" or generally cultural nature. This, it is argued, will better equip them for their role as housewife, mother, helpmeet and assistant. Hence, girls opt more frequently for such subjects as modern languages, music and art. It is interesting to note, furthermore, that even where girls are not restricted in subject choice, they have been so conditioned that many reject the "boys' " subjects in order not to appear "unfeminine" and possibly even, subconsciously, to avoid competition with their male counterparts.

There are other considerations, too, which often limit choices where there may

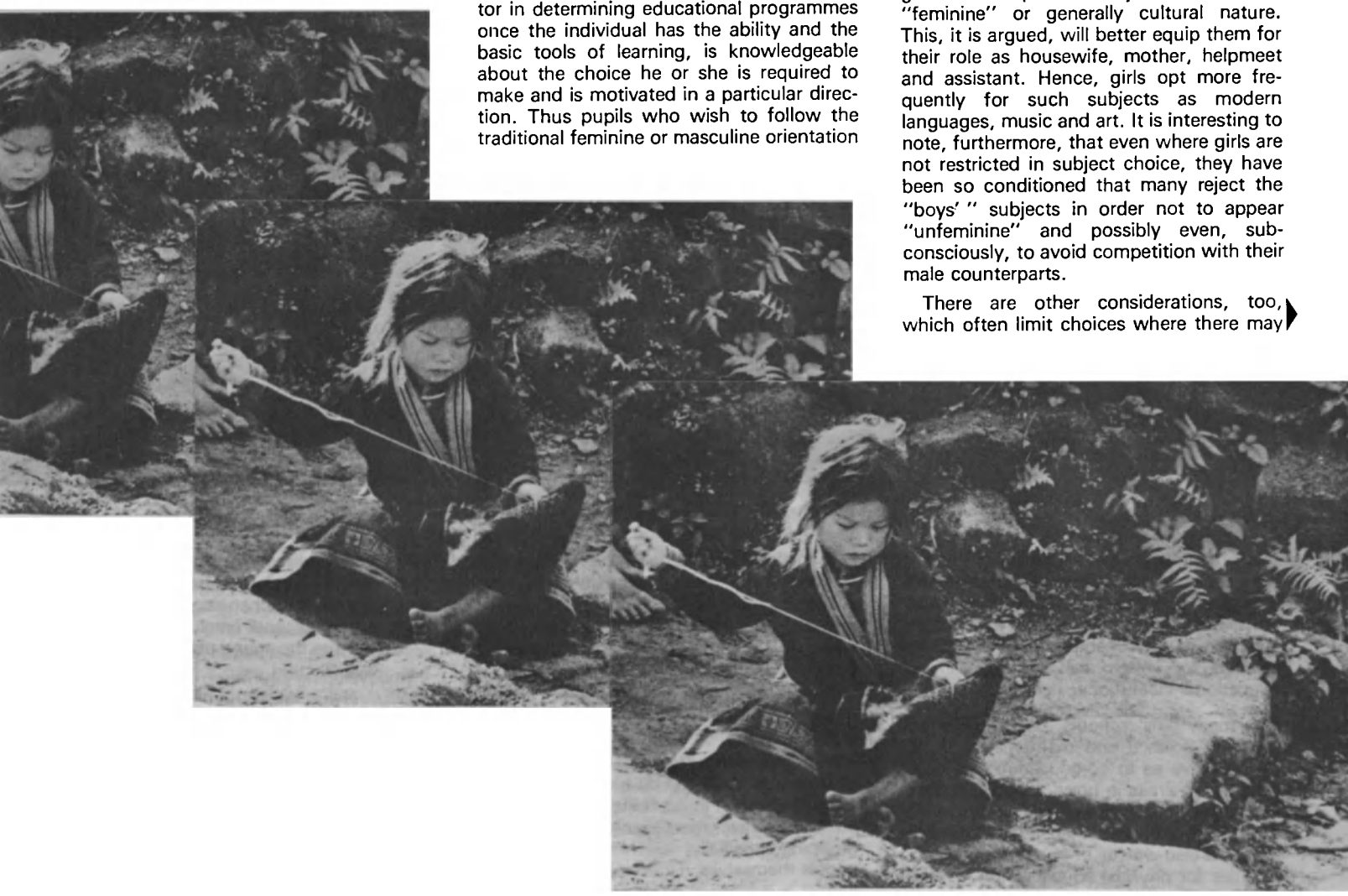
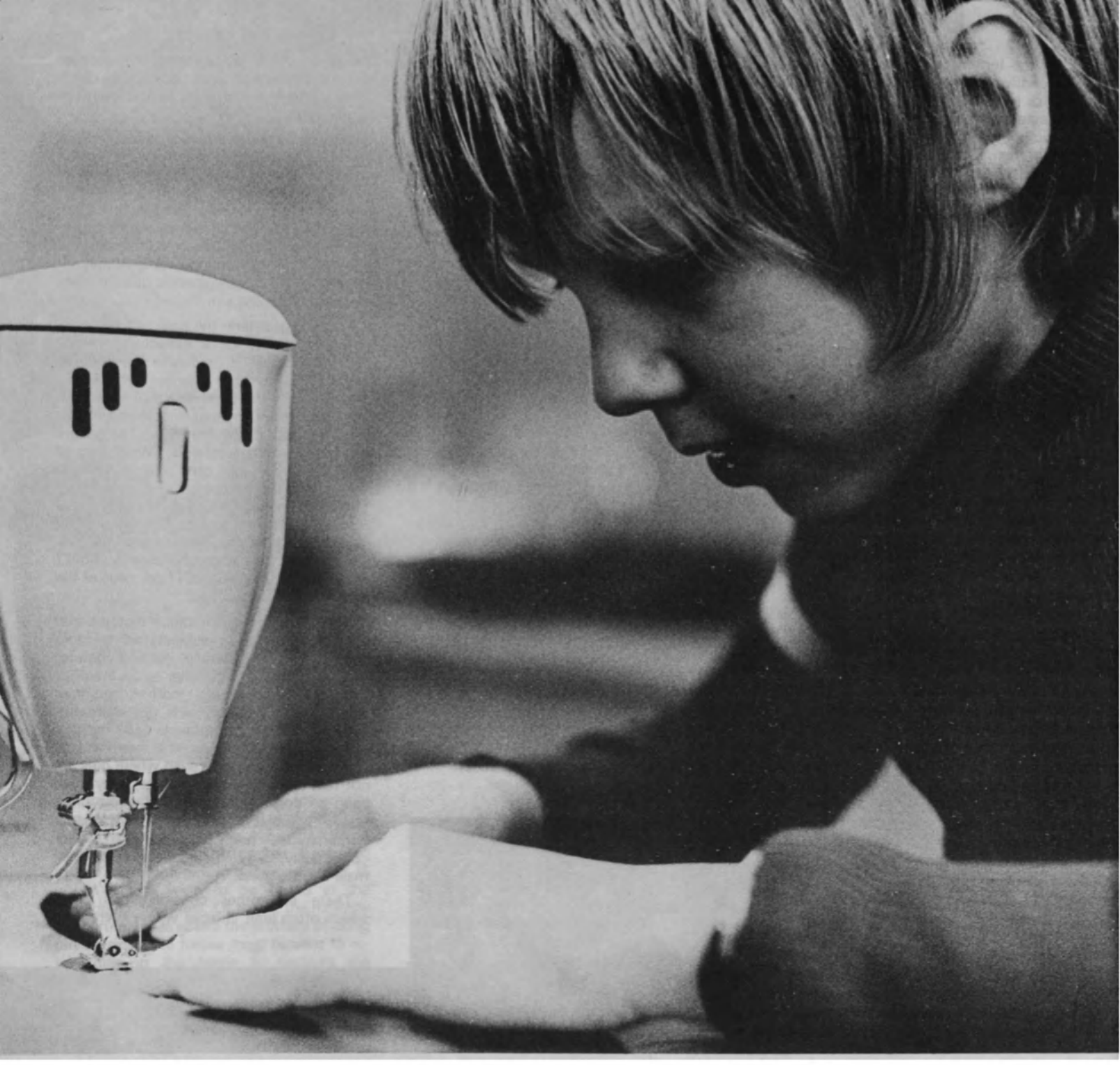


Photo © Surakiat Kongyingyong, Thailand. Third Photo Contest in Asia

TRADITION'S HOMESPUN THREADS. In a mountain village, a girl works at her mother's feet. It is in the home and the family that traditional ideas about manhood and womanhood are transmitted to children long before their schooldays.



seem, at first glance, to be no curriculum differences. In some countries, there are still a number of single-sex educational institutions, both public and private. It is not uncommon in such institutions to find fewer facilities for certain subjects than in co-educational institutions.

In many girls' schools, provision for the study of science and mathematics is not as extensive as in co-educational or boys' schools, whereas in boys' schools, modern languages, music, drama and other cultural pursuits receive less than adequate attention. It is also worthy of note that funds and facilities for physical education for boys, in both single-sex and co-educational schools, are usually much greater than those provided for in girls' programmes. In addition, the emphasis placed on organizing and projecting physical education activities for boys can very readily be judged by the attention given to this facet of school work in the media in many countries.

Single-sex schools do, however, continue to have a number of advocates even in societies where equalization of social roles between the sexes is at a very advanced stage. It should also be recalled that in places where strong religious traditions prevail, such as are to be found among Muslim people, girls either receive an education in single-sex schools or not at all.

Still, arguments stressing the harm which single-sex schools can do to the functioning of the individual in adult life continue to be put forward ever more vigorously by several groups, especially teachers and young people themselves. That they are making an impact is evident in as far as curriculum differences have lessened quite considerably in an increasing number of countries.

It is also encouraging to note that greater care is being taken in the preparation of reading schemes at all stages, in an effort to eliminate the marked sex differences which were so typical, especially in the earlier years of schooling. In addition, reports indicate that many secondary schools are responding favourably to changing attitudes on the part of parents and employers and under pressure from the young people themselves.

In developing countries, the need to make the fullest use of all human resources has probably been a very important factor in the drive to overcome the severe shortage of trained personnel. As a Nigerian specialist, Pumla Kisosonkole, has written:

> The question is still being asked: what are girls educated for? and, What should be included in their education? There was a time when it was believed that it was enough for a girl to be educated to be a homemaker, that is, a good wife and mother. She was, therefore, subjected and conditioned to a curriculum which would result in a mass production of homemakers. To a large extent, some women still prefer the protected life of the home, but grumble at the chores that the

Photo M. Markefelt © G. Bern, Paris

Hems and seams hold no mysteries for this Swedish schoolboy, but is he interested in sewing or in the functioning of the sewing-machine? Too often schools tend to accentuate the rift between the sexes by arranging their syllabuses in accordance with preconceived ideas about the roles of men and women. In some countries, schools are attempting to counter the notion that there are such things as "boys' subjects" and "girls' subjects". The attitudes of the children themselves in this respect is largely determined by the attitudes of the society in which they live.

role carries with it. On the other hand, there is growing a levelling-up of interest, with men wanting to be involved in the preparation of their families. I have lived to see in my own society, young fathers looking after the baby and preparing the family meals, whilst the young wife goes to college to study for her degree.

Closely allied to the problems caused by differing educational programmes between the sexes is the matter of career and vocational guidance. First, it would seem that insufficient attention is given to this in many school systems. Second, guidance is often provided by persons whose attitudes and traditional orientation to the world of work perpetuate and extend the obvious inequalities and latent discriminations in the curriculum.

It is fair to admit that in an increasing number of countries, there have been efforts to furnish information about a wider range of occupations for girls but the tendency to underplay certain types of careers for both boys and girls along restrictive sex lines is still quite prevalent. There is some evidence, too, that unduly early specialization combined with a guidance programme initiated at too late a stage tends to result in the choice of a career normally distinguished by a sexual stereotype. This has been further reinforced by school systems which make no effort to change the status quo.

Further, the whole scope of guidance and counselling programmes needs, in too many places, to be seen in far wider terms, making provision for young persons to develop greater understanding and acceptance of themselves and their capabilities. From this, more realistic career goals can be set. It is encouraging to note that there has been a considerable development in this area of school life and that, from all indications, the tendency to present a more useful and wide-ranging programme continues apace.

The efforts of schools could be greatly assisted by employers who should be actively involved with the school and other community groups in providing a better understanding of the problems and of the need for change in sex stereotyping as far as employment is concerned.

It is obvious that teachers play one of the most important roles in the full development of the individual child. It is therefore, critical in any consideration of how discrimination operates within the school for their attitudes, perceptions and expectations to be examined as to the part played in differentiation processes. To recognize that these have far-reaching effects is not to detract from the contribution that the majority of teachers make to the overall process of education.

However, teachers, like all other human beings, are the products of the societies in which they have lived and reflect the conditioning inherent therein. It is, therefore, to be expected that, unwittingly perhaps, they pass on to their students the ideas and attitudes which are a part of their make-up.

At the early stages of formal education, the vast majority of teachers are women. Thus, they are very likely to expect their girl students to behave, learn and respond in the manner which is second nature to themselves. They also expect the boys to respond and to show interest in the way they have "known" that boys behave.

A study carried out among Canadian secondary teachers revealed a "tendency for teachers to use their own behaviour as the norm for their particular sex on the dimensions 'active-passive' and that these internalized norms fit the socialized stereotypes (male—active and females—passive)". Further, it was pointed out in the same study that "teachers observe noticeable traditional sex role differences in the class-room and feel that students want to be treated accordingly. This evidence suggests that teachers may be shaping sex role behaviour along traditional lines".

Thus teachers provide learning experiences in keeping with pre-determined concepts. For example, boys are provided with mechanical toys and girls with things which pertain to a domestic role. The differentiation in treatment is even manifest in what pupils are required to do around the classroom and school.

A group of African teachers observed that in some places, especially in rural areas, the girls "are treated as if they were there to serve the male students and teachers". Further, in order to ensure success for the boy who is being prepared for higher studies and for earning a living, the teacher devotes more time and attention to him than to her girl students.

It has also been observed that girls whose scholastic achievements are comparable to those of boys, are more likely to be influenced by social pressures and are often diverted from their goals because of misgivings and lack of confidence resulting from teacher attitudes. It also happens quite frequently, whenever restrictions have to be made in the provision of programmes or facilities for programmes, that girls' programmes are the first to be considered.

The discriminatory practices which are due to teacher attitudes are those which will be the most difficult to change. There are those who believe that they will only disappear with time as societies themselves respond to change. While there is, of course, validity in this argument, teachers can assist in accelerating changes by recognizing their need for reorientation and by being ready to carry out their own personal self-examination to ascertain how their attitudes and perceptions are in fact determining the development of their pupils.

It is to be hoped that action will then follow to dissipate those attitudes which may be having a less than desirable effect. Teacher training institutions should also make it an integral part of their programmes to help students to appreciate this problem and its implications and provide adequate opportunities to overcome it during this vital pre-service period of preparation.

■ **Fay E. Saunders**

This article is adapted from a paper first published in The Child's Right to Education, *published by Unesco, 1979*

MAESTRO COMPUTER *(continued from page 33)*

line more pleasing than another? This is an aesthetic question which seems difficult to answer in quantitative terms. Nor do I believe that the precise reasons will ever be found. For centuries past, analysts and musicologists have done all that they can to prove to us that masterpieces are masterpieces, that the melodic inflections of one composer are extraordinary and that the harmonic sequences of another are unique. Despite literal analysis and an abundance of grammatical explanation, no convincing theory has ever been produced to answer the question of what constitutes excellence and I fear that the computer will be of no help at all in this connexion.

But let us turn once again to the much more immediate problem of training. The entry of computer technology into the world of music means that new disciplines will have to be learned. Mathematics, computer programming and the physics of sound must henceforward form part of the curriculum of the apprentice musician. At the same time, the new technology should encourage the practitioner to perfect his skills, and to enhance his own sensitivity to sound; it should help him to listen more analytically, to distinguish the components of a harmony and to modify their relative importance, and to perceive immediately the effect of this modification to tone-colour; his understanding of the role and function of timbre will be facilitated accordingly.

Before concluding, I must refer to one of the most urgent issues faced by non-instrumental music, the question of its storage and diffusion. The past sixty years have seen revolutionary developments as far as the conservation and dissemination of recorded works is concerned; it may be supposed that the computer and the techniques of digital computing will bring further immense changes in this field.

First and foremost, the possibility of stocking digitally coded sound permits conservation over longer periods, since the method of encoding excludes all possibility of sound interference or degradation. As far as synthetic sound is concerned all that need be stored are the parameters required for its reconstitution by the computer; this will inevitably lead to a profound transformation in the concept of musical scores, and the characters and symbols employed in their transcription. With regard to diffusion, it may be hoped that the incorporation of digital devices in electro-acoustic equipment will enable music-lovers everywhere to become more active listeners, and allow them to express their individuality by transforming and to a certain extent manipulating recorded sounds.

From all the above, it may be seen that music has nothing to lose from contact with the computer. For my part, I believe that it has much to gain, provided that the meeting takes place on fertile ground. Far from crushing or annihilating individuality, the new techniques present a challenge, no greater and no less than that issued by their predecessors, to those qualities of inventiveness, ingenuity and outstanding personality which have at all times been necessary for the creation of new works of art.

■ **Pierre Boulez**

Letters to the editor

SOLIDARITY AND SELF-HELP FOR THE SAHEL

Sir,
International Year of the Child 1979 made us more aware than ever before of the critical problems facing the developing countries and especially the problems of the Sahel region of Africa. We learned about the Sahel in geography lessons and from essays by children in our class who know about the situation there.

One of our classmates suggested that we should create a group to help the children of the Sahel, each of us making a regular contribution of two francs a week. The idea was immediately accepted.

We hope that our project will help to bring a little more food, technical, scientific and educational assistance, and above all moral support, to the people of the Sahel. To encourage other people in the quest for solutions to the grave problems of our time we organized a special exhibition in our school's documentation centre.

Would you tell us where we should address our 1,270 francs?

The children in our class would very much like to make contact with other children in a school in one of the countries of the Sahel.

Children of class 4A
Yvon Delbos mixed secondary school
Montignac sur Vezere
France

This letter was sent to Unesco's Co-operative Action (CO-ACTION) Programme, which offers individuals, groups and institutions the opportunity to participate in self-help community projects throughout the world. The contributions from the children of Montignac sur Vezere will go towards a Co-Action development project to improve educational and nutritional facilities in the Sahelian region of eastern Senegal. Donations to the Co-Action Programme, in the form of cheques, international money orders or bank transfers, as well as requests for further information, should be addressed to: Unesco Co-operative Action Programme, OPI, 7 Place de Fontenoy, 75700 Paris, France. EDITOR.

YOUTH AND TOMORROW'S WORLD

Sir,
An ardent reader of the *Courier*, I admire the objectivity with which you cover the problems of this tempestuous world. Your coverages of the problems of pollution and the arms race were unique. Children are the hope for the future. Why should their future be threatened by adult myopia, insensitivity, greed and conceit? I should like you to highlight the problems uncontrolled pollution and the arms race pose for young people who are a light in the darkness of this vainglorious and bewitched era.

Chris Agugdesi
University of Lagos
Nigeria

We regret that owing to a technical error during the printing of the colour pages, Wassily Kandinsky's painting *Yellow-Red-Blue* (page 21) is reproduced upside down.

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• **Red Thread Riddles,** by Virginia Allen Jensen and Polly Edman. A fun booklet for sightless children of six to ten. It has embossed illustrations in colour, and its text is in Braille and ink-print, so that both visually handicapped and non-handicapped children may use it. (Requests for copies of this booklet should should be sent to Mr. F. H. Potter, Unesco Courier Division, Unesco, Place de Fontenoy 75700 Paris, France.

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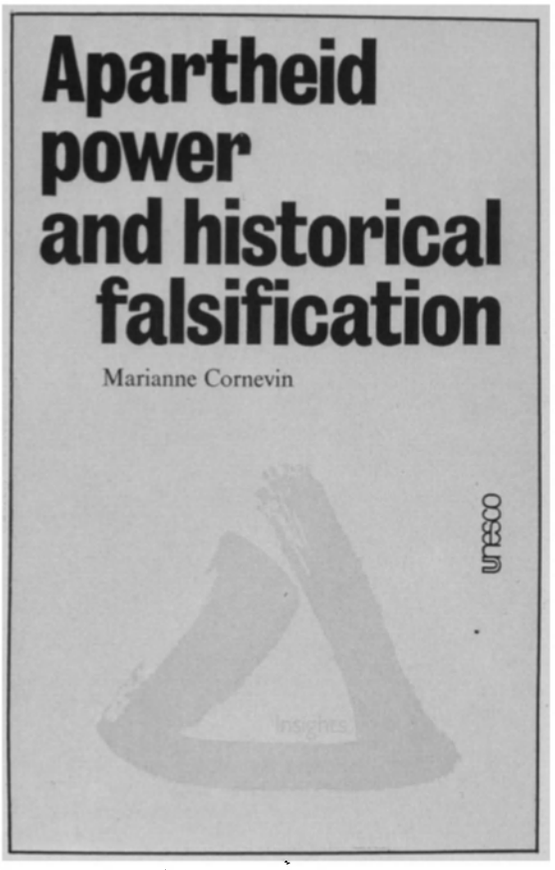

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April 1980

news from unesco

A bulletin published by
the Office
of Public Information
Unesco
7, Place de Fontenoy
75700 Paris, France

Director-General Appeals for Nicaragua's Literacy Campaign

On 24 March, Nicaragua launched a national literacy crusade dedicated to "the heroes and martyrs of the liberation of Nicaragua". The Director-General of Unesco pledged support for the campaign in a recent appeal to the international community made in Paris.

Few nations had endured so much physical and psychological suffering, said Mr. M'Bow. Following the earthquake of 1972 had come the liberation struggle in which 35,000 had died and 100,000 had been injured out of a population of 2,200,000. In the task of reconstruction, it was necessary to mobilize all the country's manpower, and the campaign for the eradication of illiteracy had been planned to serve as a lever for an educational and social advancement movement extending to all categories of the population.

Beginning in March, the campaign will enlist the services of 200,000 literacy teachers who, for six months, will live together with some 850,000 illiterates in what the Director-General described as "a stirring experiment seeking to bring about a profound change in the relations between the various social strata in the country".

Nicaragua would not be able to eradicate illiteracy without support from the world community, however, and it was hoped that international solidarity would result in a contribution of $20 million. The key objective was the achievement of general literacy throughout the country, because illiteracy was a major obstacle to conscious participation by all citizens in the task of national revival.

The Director-General said that contributions in kind would also be welcomed: pencils, paper, exercise books and blackboards as well as audio-visual aids, motor vehicles, clothing, oil lamps, and foodstuffs.

Mr. M'Bow called on all governments, public and private institutions, churches, trade unions, women's organizations and youth movements, and "all those who enjoy the benefits of education" to help "those in Nicaragua who are endeavouring to take their future in hand".

Donations from Austria and the Fed. Rep. of Germany

Austria has donated $10,000 to Unesco's voluntary fund for development of knowledge of human rights through teaching and information. The fund was created following a decision taken by Unesco's Executive Board last November.

The Federal Republic of Germany has decided to contribute $110,000 to Unesco's World Heritage Fund for the period 1979-1980. Established in 1972 in connexion with the Convention concerning the Protection of the World Cultural and Natural Heritage, the Fund is used for international assistance for the protection and preservation of monuments included on the World Heritage List.

Apartheid and the Falsification of History

The myths used to justify apartheid are analysed in a book entitled *Apartheid: Power and Historical Falsification*, just published in the Unesco series "Insights". The book denounces the false assumptions underlying this ideology.

The keystone of the present internal policy of the South African Government lies in the creation of "homelands": 72 % of the population will be grouped in ten "independent" black States, consisting of largely arid lands that are poor in mineral resources. Altogether, these homelands represent 13 % of the total area of South Africa. The whites—16.5 % of the population—will retain 87 % of the land, divided up so as to give them almost all the country's important mineral and agricultural resources.

South Africa will then become a "white" state, surrounded by "black" satellites whose peoples will be deprived of South African nationality and who will subsist mainly on assistance supplied by the South African Treasury.

This policy of "homelands" is founded on a particularly well established myth: that the first Dutch colonists settled on uninhabited territory to which the blacks only migrated later. According to another version of this myth, the two peoples arrived in South Africa at the same time. But whatever the case, the blacks have no rights either to the country or to its wealth which was created entirely by the knowledge and industry of the whites.

The author of the book, Marianne Cornevin, refutes this theory with arguments based on authoritative archaeological and anthropological evidence. She also shows that the history of South Africa has been made by blacks just as much as whites, and that it began long before white colonization.

Mexico Conference Calls for Strengthened Unesco Action in Latin America and the Caribbean

A new model of development in which the only aim of education was the development of man's potential and in which education would contribute to building a future that was culturally more independent was the main conclusion of the Regional Conference of Ministers of Education and Economic Planning in Latin America and the Caribbean, organized in December by Unesco in Mexico City.

Addressing the closing session of the Conference, Mr. Amadou-Mahtar M'Bow, Director-General, welcomed the call by delegates for intensified Unesco action on behalf of the countries of the region. He noted the advance made in Latin America since the first education ministers' conference at Santiago de Chile in 1966 and stressed that education has been placed in the context of total development which seeks to reconcile economic growth and social and cultural progress with the aspirations of the individual and the demands of society.

Twenty-six States of the region participated in the Conference, organized by Unesco with the co-operation of the United Nations Economic Commission for Latin America (ECLA) and the Organization of American States (OAS). Fifteen ministers of education and five ministers responsible for economic planning took part in the discussions.

In a declaration adopted at the end of the conference, the delegates affirmed that "Education is an essential tool for the release of man's highest potential to create a more just and balanced society". They also stressed the growing impact of the mass media and urged that they be used to make a positive contribution to education.

The conference recommended that the States of the region establish basic education of the longest duration possible, the adoption of a clear policy to eliminate illiteracy before the end of the century, expanded educational services for adults and a gradual increase of educational budgets.

Among the priority objectives agreed were a proper relationship between educational processes and the world of work, the development of integrated programmes on nutrition, health, basic rural sanitation and housing, as well as closer links between school education and permanent education.

A Book a Day

Unesco publishes a book a day, a fact revealed in an exhibition held in Paris from 17 January to 28 March at the French Institut National de Recherche Pédagogique. On display at the Institute were journals, books, studies and surveys as well as documentary films, educational recordings, slides and scientific maps. More than a third of this production is devoted to various aspects of education—methods, research, innovations, teaching, lifelong education, planning and financing—as well as reference works.

Nubia Medal

To celebrate 20 years of international solidarity and the successful conclusion of the International Campaign to Save the Monuments of Nubia Unesco has issued a commemorative medal, available in gold, silver and bronze. The obverse of the medal shows the head of Ramses II and bears the inscription "Unesco Nubian Campaign 1960-1980". The reverse illustrates the Kiosk of Trajan at Philae menaced by the rising water level.

Report on Communication Problems Presented to Unesco's Director-General

On the occasion of the handing over of the Final Report of the International Commission for the Study of Communication Problems, the Director-General of Unesco, Amadou-Mahtar M'Bow, presented the Chairman of the Commission, Nobel and Lenin Prize winner Sean MacBride of Ireland, with the Organization's silver medal for meritorious service to Unesco.

Thanking Mr. MacBride and the fifteen other members of the Commission for their work over two years, Mr. M'Bow said at a press conference at Unesco's Paris headquarters on 22 February that their study, carried out following the decision of the 1976 General Conference of Unesco, had been undertaken in total freedom and without directives. He had chosen Mr. MacBride to head the Commission in its important task because he possessed rare qualities of integrity and courage which he had shown during a life-time devoted to the struggle for freedom, justice and mutual respect.

The Director-General said that the report would now be published in Unesco's official languages and given wide distribution before the 1980 General Conference in Belgrade, along with his comments on how its contents might concern the future work of the Organization.

Mr. MacBride said he was gratified to report general and genuine agreement among the Commission, who made up a group representing the world's diversity of political, ideological, cultural and socio-economic views. "While we may have varying interpretations of the concept and of the means of achieving it, we are convinced that the development of a new, more just and more effective world information and communication order is essential to the progress of mankind", he said.

The Report of the Commission deals with the right to receive, seek and impart information as a fundamental human right and it was in this light that Mr. MacBride introduced the report to some hundred representatives of the media from all parts of the world.

A consensus was reached that fundamental communication problems transcended mere media questions and were an integral part of the overall socio-economic, cultural and political patterns of today's societies, he said. The Commission had focussed on human rights and freedoms and on the extension of the potential of communications development to further peoples' well-being and aspirations.

The chairman of the International Commission for the Study of Communication Problems, Sean MacBride, with Unesco Director-General Amadou-Mahtar M'Bow, at a press conference held on February 22 at Unesco's Paris headquarters on the occasion of the handing over of the Commission's final report.

Photo Unesco

Convention Adopted on Recognition of Education Diplomas

Representatives of thirty-five Unesco Member States meeting in Paris from 17 to 21 December unanimously adopted the text of a convention on the recognition of higher education studies, diplomas and degrees in States belonging to the European region, which includes Canada, the United States and Israel as well as the countries of Europe. To ensure implementation of the convention, which will come into force when it has been ratified by five States, the contracting States agreed to set up a regional committee to consider progress and any obstacles encountered.

The convention, which takes its place in the work of regional conferences of education ministers convened by Unesco in Vienna (1967) and in Bucharest (1973), is faithful to the spirit of the Final Act of Helsinki. It is the fourth instrument to be adopted as part of Unesco's concern to promote the mobility of students and teachers and evaluate their competence. The previous conventions, the first two of which have already come into force, were signed by the States of Latin America and the Caribbean (Mexico City, 1974), the Arab and European States bordering on the Mediterranean (Nice, 1976) and the Arab States (Paris, 1978). Similar conventions for the African States and for the States of Asia are in course of preparation.

The convention marks an important step towards a universal convention, the ultimate aim fixed by Unesco's General Conference.

Unesco has 149 Member States

Equatorial Guinea, the Republic of Botswana and the Democratic Republic of Sao Tomé and Principe became Member States of Unesco on 29 November, 16 and 22 January respectively.

Unesco now has 149 Member States.

Asian Music Rostrum Selects Nine Works

Works ranging from short pieces of vocal or instrumental folk music to full length compositions, 77 in all, were presented at the fifth Asian Music Rostrum, organized recently in Baghdad by the International Music Council.

The nine chosen by the selection committee for special promotion through broadcasting channels came from five countries: India—*Raga* played by violinist Lalgudi Jayaraman; Iraq—*Maqams* sung by Salah Abdel Ghafur and Maida Nazhat, and variations on a *Maqam* played by Munir Bashir on the *ud;* the Republic of Korea—ritual music recorded on Chindo Island; USSR—excerpts from *mughams* played by traditional musicians on the *duduk* and *zurna* (double reed woodwind instruments); and Vietnam—an excerpt from "Hat bôi", the traditional music theatre. The committee recommended eleven other works considered to be of major artistic interest.

The aim of the Asian Music Rostrum is to make known through radio organizations outstanding examples of traditional, classical and modern music representing different schools and cultures of Asia and Oceania.

Black Holes: A Cosmic Mystery

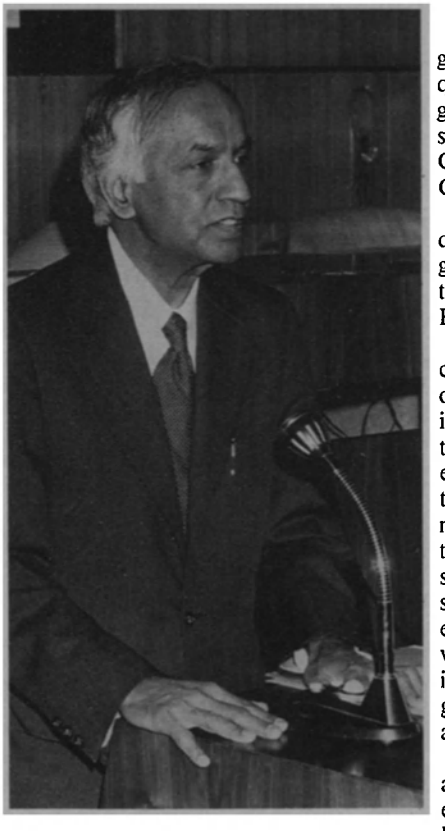


Photo Michel Claude, Unesco

Professor Chandrasekhar, professor of physics and astrophysics at the University of Chicago, explains a point during his lecture on "Black holes: the why and the wherefore", given at Unesco headquarters in Paris on January 24, 1980.

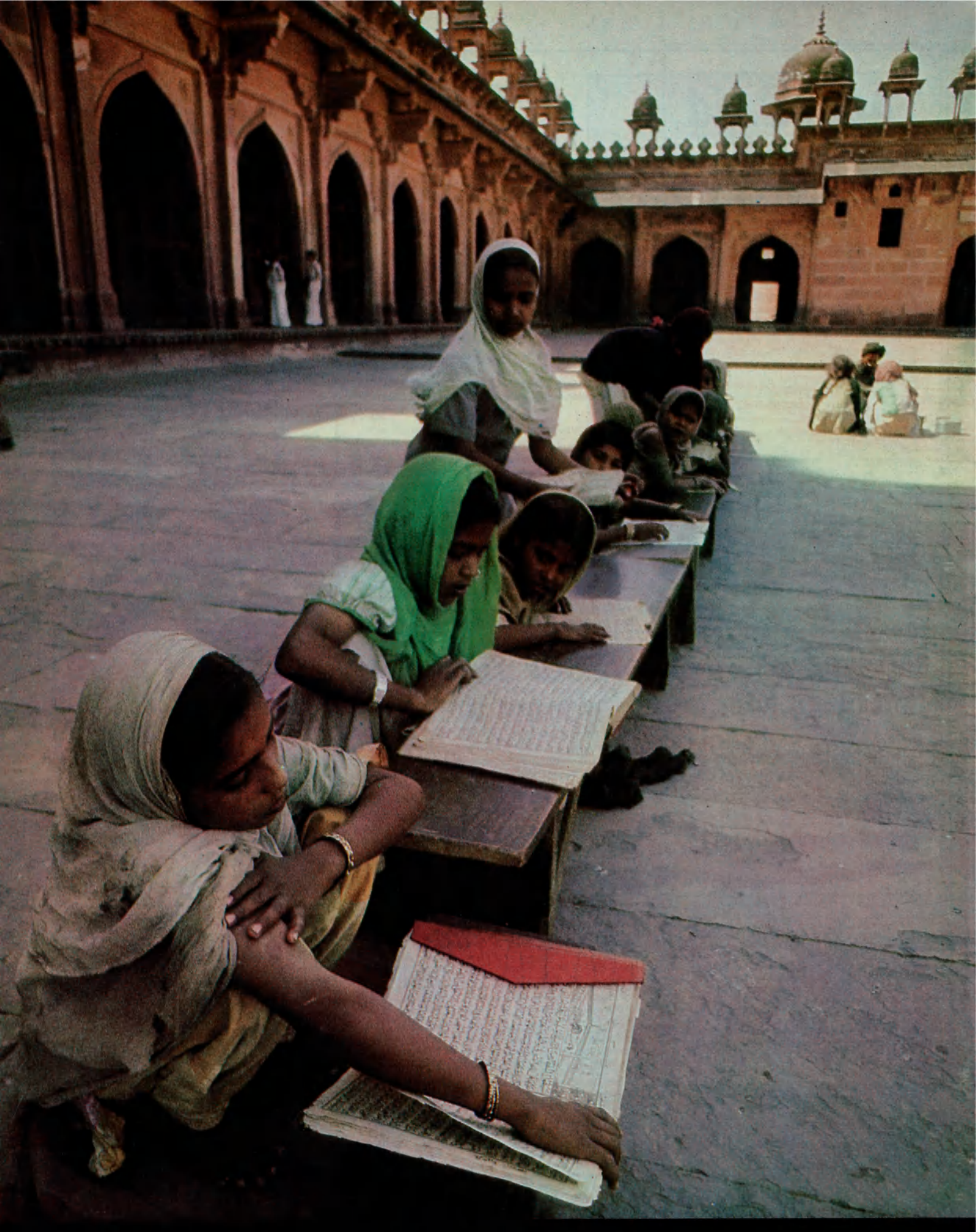
What are black holes and how do they get their name? These were two of the questions answered in a recent lecture given at Unesco Headquarters by an Indian scientist, Professor Subrahmanyan Chandrasekhar of the University of Chicago.

A black hole consists of the remains of a dead star. It is so dense and the gravitational field around it is so strong that even light cannot escape from it. Hence the name.

Black holes originate when a star collapses, a phenomenon which frequently occurs in the universe. A star whose mass is more than three times that of the sun is too heavy to be stable. It explodes, emitting in a few days radiation equivalent to that emitted by the sun in tens of millions of years. It then implodes and, in the space of a few minutes or even a few seconds, its total mass collapses to form a sphere, several kilometres in diameter, of enormous density (one cubic centimetre weighs a hundred million tons). Matter irresistibly engulfed in these endless abysses gives out specific signals which astronomers can now detect.

What happens on a cosmic scale may also happen within the individual atom and elementary particles could be a form of black hole. Many scientists are today working on this hypothesis.

Professor Chandrasekhar's lecture was the fourth in a monthly series on "New Horizons of Scientific Knowledge" organized by Unesco and given by distinguished scientists.



In Uttar Pradesh State (India) a class of young girls enjoys a reading lesson. In recent decades great progress has been made in providing equal educational opportunities for both girls and boys. But in spite of many real achievements, young women throughout the world still face discrimination of one kind or another at all levels of education (see page 33). Even today, of the world's 814 million illiterates, 60 per cent are women.